

National Parks & Wildlife Service
Tóchar Midlands Wetland Restoration Scheme

Lough Garr
PFS Site No. 1004
NHA 001812

Fen Restoration Plan

April 2026



ARUP



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Fen Restoration Plan
Lough Garr PFS Site No. 1004

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Arup

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Executive Summary

Lough Garr, located 16 km north-west of Mullingar in Co. Westmeath, is designated as a Natural Heritage Area (NHA) (site code: 001812) of significant conservation importance. The site is small and relatively natural, mostly made up of Annex quality 7140 Transition mires and quaking bogs with a natural gradation into other habitats, including bog, wet woodland and swamp. A raised bog is found on the site, consisting of two areas of high bog, which have been divided by a bog road. Much of the high bog has vegetation typical of a Midland Raised Bog, mainly dominated by Ling Heather.

The ecological integrity of Lough Garr has been impacted by several factors:

- Drainage works that have altered natural water levels.
- Nutrient enrichment from adjacent agricultural activities.
- Ineffective grazing regimes (both overgrazing and absence of grazing).
- Encroachment by scrub and invasive species; and
- Invasive species e.g. scattered self-seeding conifers.

These pressures have resulted in a decline in habitat quality and threaten the species and ecological functions the site supports.

Actions of the Fen Restoration Plan

The restoration plan for Lough Garr sets out a coordinated series of measures to address key pressures affecting the site and to support the recovery of its unique wetland habitats.

Central to the plan is the management of water levels. Although there is historical evidence of a reduction in open-water extent and drainage appears to have been a key pressure on fen hydrology, the existing drain is currently helping to maintain water levels within the fen, likely due to long-term vegetation growth and sediment deposition creating partial blockages. The main intervention is to avoid modifying the existing drain or creating new pits or ditches, and to carry out ongoing monitoring of both groundwater and surface water across the site to ensure wet conditions, as these are essential for the persistence of fen habitats. The results of this monitoring may or may not indicate the need for further interventions in the future, such as installing an adjustable weir on the main internal drainage channel.

The fen habitat within Lough Garr is relatively young, evolving from drainage of the former lake that was historically located within the site. Therefore, it is deemed that this vegetation community is in a current state of flux. No significant pressures or threats to the fen habitat were identified and therefore the actions of the plan are to continue monitoring the vegetation community, alongside the water levels, to see how it naturally evolves and consequently what appropriate actions to take in relation to the climax community that may subsequently persist.

Based on the monitoring completed to date, there is no evidence of nutrient pollution since nutrient concentrations are below environmental thresholds. Regular water quality assessments are proposed to monitor nutrient levels. This will ensure that surrounding activities such as forestry and agriculture do not become a water-quality pressure and will also support adaptive management of the site. Mitigation measures to prevent potential nutrient pollution pressures include collaboration with local landowners and farmers through established programmes and incentives. This includes efforts to reduce nutrient runoff from surrounding agricultural land, as well as providing alternative livestock watering solutions to prevent direct access to the fen.

Finally, the plan recognises the importance of stakeholder engagement and compliance. Active engagement with landowners, statutory bodies, and other local stakeholders will help ensure that restoration actions (if needed) are practical, widely supported, and compliant with relevant legislation.

The plan also notes that there are no archaeological features within the site boundary, and therefore no associated risks to peat stability or cultural heritage.

Benefits of the Fen Restoration Plan

The current water levels within the site are deemed adequate for supporting the existing (young) fen community. Therefore, the proposed actions enable a better understanding of what the baseline hydrology is and whether there is any active natural succession in vegetation community that is occurring as a result of the current levels. The benefit of understanding this baseline is to ensure that no active management is undertaken that is later considered to be ineffective. The longer-term monitoring will provide valuable data to inform appropriate management at a later stage.

Acknowledgements

This Restoration Action Plan was prepared following consultation with a broad range of groups and individuals involved in peatland restoration, local residents and stakeholders through several workshops.

Thanks to the members of the SAR Directorate, NPWS Regional Staff, Ecological Assessment Unit (EAU), Ecological Guidance and Advisory Unit (EGAU), Wildlife Enforcement and Nature Protection Directorate, Conservations Measures Unit, Conservation Planning Unit and the Tóchar Wetlands Project Team.

Tóchar Wetlands is a wetlands restoration project, co-funded by the Government of Ireland and the European Union through the EU Just Transition Fund Programme. It is managed by the National Parks and Wildlife Service, of the Department of Housing, Local Government and Heritage.

1 Introduction

1.1 *Purpose of this Fen Restoration Plan*

This Fen Restoration Plan (FRP) report has been prepared by Arup on behalf of the National Parks and Wildlife Service (NPWS) to set out proposals for the restoration of the Annex I¹ quality 7140 Transition mires and quaking bogs (hereafter referred to as 7140 Transition mires) habitat within Lough Garr NHA (site code 001812), contributing to a favourable conservation condition of the fen habitat. While NHAs do not have Site-Specific Conservation Objectives (SSCOs), objectives from comparable designated sites have been used as a basis to inform the assessment of favourable conservation status.

The main aims of the FRP are to maintain or enhance the quality of existing fen areas and improve hydrological conditions to support fen expansion, contributing to their favourable conservation status. However, in some areas, it must be recognised that restoration to increase areas of existing fen may not be possible due to unsuitable hydrological conditions, and the objective may simply be to ensure no further deterioration.

Although the focus of the restoration plan is on fen habitat it is anticipated that restoration actions will also benefit other wetland habitats, including FS1 Reed and large sedge swamps and WN6 Wet woodland types, which were mapped at Lough Garr NHA during previous surveys (O'Neill, et al., 2023). The implementation of the actions proposed within this FRP report may also provide wider improvements to biodiversity, reduce carbon emissions and potentially improve water quality, all of which may be demonstrable under eventual post implementation monitoring.

While full-scale hydrological restoration aimed at re-establishing the site's former lake would offer potential ecological gains for aquatic species and waterfowl, this would result in the loss of existing fen areas, and by extension, the flora and fauna of which it supports. Therefore, restoration will be carefully targeted to deliver hydrological and ecological improvements while restoring, expanding and maintaining the extent and quality of existing fen habitat, ensuring a balanced approach that supports favourable conservation outcomes across priority habitats and species.

1.2 *Wider benefits of fen restoration*

Fens are vital habitats due to their rich biodiversity, supporting a wide array of flora and fauna, many of which are rare or endangered. They act as natural water filters, purifying water by

¹ Each habitat and species type protected under the EU Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) is given a unique numeric code so that all Member States use the same reference in legislation, reporting and monitoring. Each habitat and species code is an index in the Annex lists with codes grouped by habitat family.

trapping pollutants and sediments, thus enhancing water quality downstream. Additionally, fens store credible amounts of carbon in their peat soils, contributing to climate change mitigation by reducing atmospheric carbon dioxide levels. Their ability to absorb and gradually release water helps regulate water flow and minimize flood risks. Beyond their ecological importance, fens hold cultural, historical, and recreational value, offering opportunities for education, research, and outdoor activities. Although some fens in Ireland are not protected as Special Areas of Conservation (SACs) or Natural Heritage Areas (NHAs), they remain crucial for biodiversity and climate resilience.

Peatland drainage and extraction transforms a natural peatland which acts as a modest carbon sink into a carbon source (Waddington & McNeil, 2002; Alm *et al.* 2007). The EPA- funded Carbon Restore Project (Wilson *et al.*, 2012) found that rewetting of drained peatlands can lead to restoration of functional peatland, such as the return of typical plant and animal species, which in turn may lead to the restoration of peat-formation and the C-sink function.

It is expected that areas within Lough Garr (NHA) will become a reduced carbon source/part carbon sink following implementation of the FRP which will result in revegetation of bare peat areas and improvement in hydrology via drain blocking.

The restoration of fen habitat at Lough Garr (NHA) is likely to lead to improved water quality. Well- functioning fen habitat reduces the risk of dissolved organic carbon passing into water courses and has been shown to attenuate the speed at which water moves downstream thereby reducing flood risk.

1.3 Key Pressures on Fens

The overarching (National) key pressures and threats to Annex I fen habitats (Table 1-1) have been identified in the latest Status of EU Protected Habitats and Species (Article 17 report) (NPWS, 2025).

Table 1-1: National pressures to fen habitats

Habitat/ Species	Importance	Pressure
7140 Transition mires	High	PA09 Burning for agriculture PA13 Application of natural or synthetic fertilisers on agricultural land PA22 Drainage for use as agricultural land PF02 Construction of modification (e.g. of housing and settlements) in existing built-up areas PL02 Drainage (mixed or unknown drivers) B01 Conversion to forest from other land uses, or afforestation J01 Mixed source pollution to surface and ground waters K02 Drainage K04 Modification of hydrological flow

Habitat/ Species	Importance	Pressure
	Medium	PA08 Extensive grazing or under grazing by livestock PA17 Agricultural activities generating pollution to surface or ground waters (including marine) PB24 Drainage for forestry PE01 Roads, paths, railroads and related infrastructure PI03 Problematic native species K01 Abstraction from groundwater, surface water or mixed water L02 Natural succession resulting in species composition change C05 Peat extraction
	Low	PA01 Conversion into agricultural land (excluding drainage and burning) PA02 Conversion from one type of agricultural land use to another (excluding drainage and burning) PA05 Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming) PA07 Intensive grazing or overgrazing by livestock PA21 Active abstraction of water for agriculture PB01 Conversion to forest from other land uses, or afforestation (excluding drainage) PB26 Other forestry activities, excluding those relating to agro-forestry PC05 Peat extraction PF06 Deposition and treatment of waste/rubbish from built-up areas PI02 Other invasive alien species (other than species of Union concern)

1.4 Legislative Context

There is a comprehensive system of legislation, both domestic and international, which aims to protect biodiversity at a landscape, habitat and species level in Ireland. This legislation exists within, and independently of, the planning process.

In Ireland, the most important pieces of legislation underpinning biodiversity and conservation are:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, hereafter referred to as the Habitats Directive.
- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended, hereafter referred to as the Birds and Habitats Regulations.
- Regulation (EU) 2024/1991 of the European Parliament and of the Council of June 2024 on nature restoration and amending Regulation (EU) 2022/869.
- Wildlife (Amendment) Act 2000 provides statutory protection for Natural Heritage Areas (NHAs).

- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, hereafter referred to as the Birds Directive.
- Flora (Protection) Order, 2015 (S.I. No. 356 of 2015); and
- Wildlife Acts 1976 to 2017, hereafter referred to as the Wildlife Acts.

According to the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (79/409/EEC), Member States are required to establish a Natura 2000 network of sites of highest biodiversity importance for rare and threatened habitats and species across the EU. In Ireland, the Natura 2000 network of European sites includes Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). Natural Heritage Area (NHAs) are designated and legally protected from damage under the Wildlife Act 2000 part III.

SACs are selected for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are selected for the conservation of Annex I birds and all migratory birds and their habitats. The Annex habitats and species, for which each site is selected, are the qualifying interests (QI) of the SAC Conservation objectives for the site are defined for these qualifying interests.

The EU Nature Restoration Regulation aims to restore damaged ecosystems and improve biodiversity with particular focus on capturing and storing carbon and reducing the impact of natural disasters. Specific targets include improving and re-establishing biodiverse habitats on a large scale and increasing species populations by improving and enlarging their habitats. EU countries are required to submit National Restoration Plans to the European Commission showing how they will deliver on the targets and monitor their progress.

Ireland is required to manage water resources in an integrated way under the Water Framework Directive (WFD, 2000/60/EC) and the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003). Member States are required to submit River Basin Management Plans to the European Commission showing how they will protect and improve the water environment. Restoring surface and groundwater bodies to the equivalent of 'good status' or better and to protect water from any further deterioration requires collaboration at a local and national level. Implementing the WFD supports the achievement of site-specific conservation objectives for fen habitats, contributing to improving their conservation status.

1.5 *Outline of this FRP document*

- Section 2 of this FRP report outlines details of Lough Garr and the conservation objectives for Annex quality 7140 fen habitat.
- Section 3 outlines the findings from the land and water desktop and site monitoring surveys that were carried out to inform the development of the FRP.
- Section 4 outlines the findings from the ecological desktop and site monitoring surveys that were carried out to inform the development of these FRP.
- Section 5 provides a summary of the key pressures identified following review of desktop and field data which are impacting on fen.
- Section 6 outlines the key restoration measures proposed within this FRP.
- Section 7 outlines additional considerations to inform the development of the FRP.
- Section 8 outlines the potential role players in the FRP and summarises restoration actions proposed, habitats that will benefit and further steps required to prepare for implementation.

Restoration actions proposed by this FRP assessment have been mapped in GIS format and delivered to NPWS in accordance with NPWS data standards This includes detailed mapping of the key pressures addressed by this assessment, detailed mapping of proposed restoration actions, ecological survey results and referenced sensitivity areas. GIS Shapefiles which accompany this report include all relevant data on referenced species.

2 Site Overview

2.1 Lough Garr

Lough Garr, is located 16 km north-west of Mullingar in Co. Westmeath, is designated as a Natural Heritage Area (NHA) (site code: 001812) of significant conservation importance. The site is bounded by a main road to the west and local roads to the south and east. According to the historical maps, an open water body was present within the site boundaries since at least 1829, where two islands were located to the northwest and southeast of the site. The surrounding land has historically been predominantly used for forestry and agricultural use, indicating long-term human influence on the local landscape. A drainage feature is also identified on the 6 Inch Last Edition Black & White (1829-41) historical map, suggesting early attempts of water management near the site. The drain runs along the north-eastern side of the site boundary.

The site is small and relatively natural. The Scoping study and Pilot Survey of Fens (O’Neil et al. 2023) for Lough Garr notes that the site contains a mix of habitats, including a small, raised bog, areas of marsh, patches of wet woodland, and both humid and dry grassland.

Lough Garr is mostly made up of Annex quality 7140 Transition mires with a natural gradation into habitats including bog, wet woodland, swamp and both humid and dry grassland (O’Neil et al. 2023). The site was designated as an NHA due to the presence of Annex quality 7140 Transition mire and quaking bogs (classified as PF3 under the Fossitt habitat classification system). An area of raised bog habitat is located on the western edge of the site boundary within the NHA extents. A rare habitat in the EU, it consists of two areas of high bog divided by a bog road. Much of the high bog supports vegetation typical of a Midland Raised Bog, mainly dominated by ling heather. Section 4 outlines, in detail, the habitats present within the area under review for this FRP.

Figure 2-1 outlines the location and extent of Lough Garr and illustrates the distinction between the larger Lough Garr NHA boundary and the smaller area under review for this FRP.

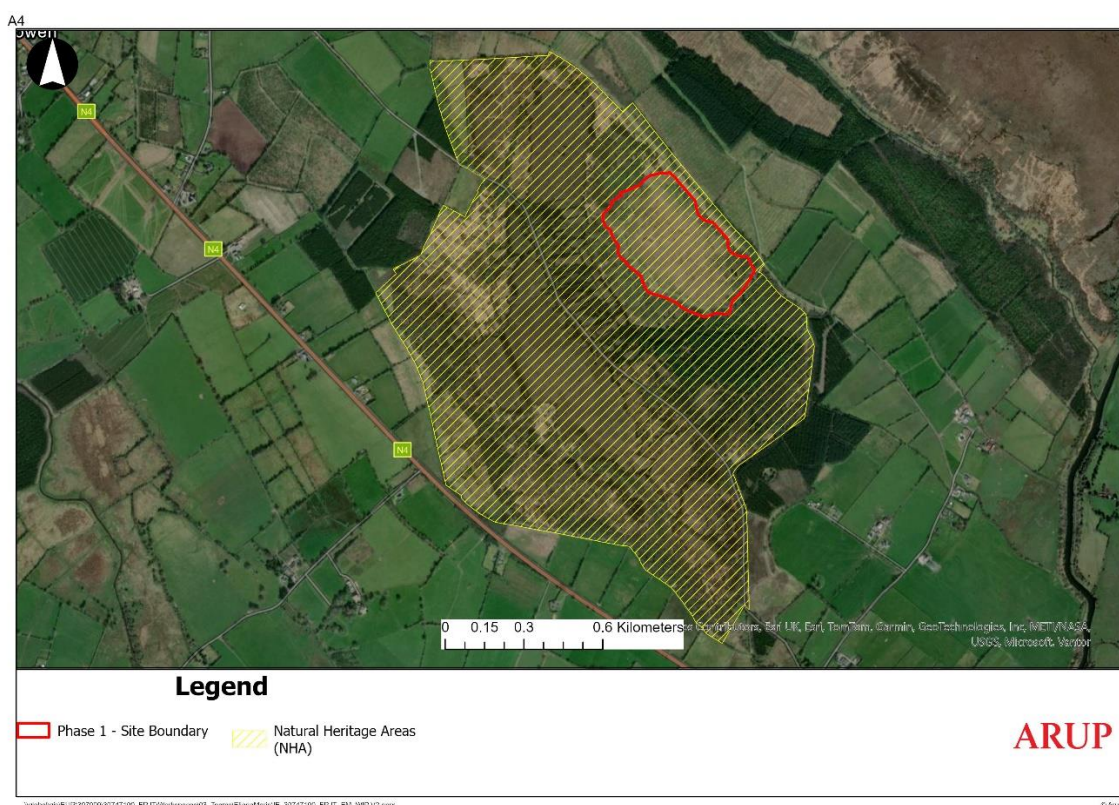


Figure 2-1: Site location map

2.2 Fen Condition Assessment

As detailed in Table 2-1, three pressures have been reported across the site in the Scoping Study and Pilot Fen Survey (PFS) (O'Neill, et al., 2023).

Table 2-1: Assessment of impacts of pressures on 7140 Transition mires at Lough Garr

Pressure Code	Pressure [sub-category]	Influence
A26	Agricultural activities generating diffuse pollution to surface or ground waters	Negative
K02	Drainage	Negative
L02	Natural succession resulting in species composition change	Negative

The results of a field evaluation (2025) of the above pressures to inform the restoration planning process is detailed in Section 5.

Lough Garr was surveyed as part of the PFS between 26th and 27th of May 2020. The conservation status of the Annex I quality habitats that form the primary focus of the PFS was also appraised during the surveys. The results of the conservation status assessment of 7140

habitat carried out as part of the PFS surveys at Lough Garr are summarised in Table 2-2. The overall conservation status of Annex quality 7140 Transition mires and quaking bogs was assessed as Unfavourable – Inadequate.

Table 2-2: Conservation Status Assessment of 7140 Transition mires (O’Neill, et al., 2023)

Annex I habitat	Area	Overall Status	Rationale
7140	<i>Favourable</i>	<i>Unfavourable – Inadequate</i>	The overall status is Unfavourable–Inadequate as future prospects are uncertain due to scrub encroachment, drainage impacts and nutrient enrichment risks.

2.3 Site Specific Conservation Objectives

NHAs are nationally protected sites under Irish legislation and are not designated under the EU Habitats Directive². Therefore, they do not have statutory Conservation Objectives. However, attributes and targets from similar Annex I habitats have been adapted for Lough Garr to provide a benchmark for favourable condition³. Maintaining habitats and species in a good condition within the site will contribute to their favourable conservation status at a national level.

For this restoration plan, an adapted objective has been applied to the Annex quality 7140 Transition mires habitat, using parameters based on Habitats Directive guidance. The restoration actions outlined by this restoration plan aim to contribute towards achieving these adapted targets.

This document does not present the full suite of attributes, targets, and measures for the Annex habitat. The selection provided in reflects a conscious decision to focus on those with clear, direct benefits from the FRP measures. While these are listed below, it is anticipated that the remaining attributes, targets, and measures will benefit as restoration measures are implemented.

² NHAs are nationally protected under Irish law and do not fall under the EU Habitats Directive. For restoration planning purposes, adapted objectives and targets based on Annex I habitat guidance for SACs are applied as benchmarks. These adapted objectives are not legally binding but provide a practical framework for assessing and improving habitat condition within NHAs.

³ Conservation Objectives for Scragh Bog - 7140 Transition mires and quaking bogs have been adapted for Lough Garr.

Table 2-3: Attributes and Targets for 7140 Transition mires (NPWS, 2018)³

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribute to achieving target?
Habitat area	Hectares	Area stable or increasing subject to natural process	Yes	Yes. FRP actions are anticipated to sustain the current area of habitat designated within the NHA.
Habitat distribution	Occurrence	No decline, subject to natural processes	Yes	Yes. Monitoring will track that there is no decline in distribution of fen habitat within the NHA. Actions such as scrub removal will be implemented which could contribute to the increase of 7140 distribution.
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	Yes	Yes. Monitoring will identify changes in soil chemistry and inform management or restoration actions needed to maintain appropriate nutrient conditions.
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain active peat formation, where appropriate	Yes	Yes. Monitoring will ensure conditions remain suitable for peat formation and inform restoration actions if water levels or vegetation composition deviate from target conditions.
Ecosystem function: hydrology – water levels	Centimeters; duration of water levels	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Yes	Yes. FRP actions include water level monitoring to assess if restoration measures are required to improve or maintain the hydrology of the fen habitat.
Ecosystem function:	Flow direction	Maintain appropriate topography and	Yes	Yes. FRP actions include water level monitoring to assess if

Lough Garr Fen Restoration Plan

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
hydrology – flow patterns		water movement regime necessary to support the natural structure and functioning of the habitat		restoration measures are required to improve or maintain the hydrology of the fen habitat.
Ecosystem function: water quality	Water chemistry measures	Maintain appropriate water quality to support the natural structure and functioning of the habitat	Yes	Yes. FRP actions include water monitoring which will inform whether there are changes in water quality
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Yes	Yes. FRP actions include vegetation monitoring to assess the current condition of the habitat, which was assessed to be good. The monitoring points include collection of both positive and negative indicators of fen habitat which will help inform any required measures. Additional information on the pressures and threats can also be collected to help inform suitable future actions for management of the fen habitat.
Vegetation composition: typical vascular plants and bryophytes	Percentage cover at a representative number of 2m x 2m monitoring stops	Maintain adequate cover of typical vascular plant and bryophyte species	Yes	
Vegetation composition: native negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Native negative indicator species at insignificant levels	Yes	
Vegetation composition: nonnative species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Yes	
Physical structure: drainage	Percentage area in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Yes	
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x	Cover of disturbed bare ground not more than 10%	Yes	

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribute to achieving target?
	2m monitoring stops			
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	Yes	

3 Land and Water

3.1 Desk Study

3.1.1 Meteorological Conditions

Understanding long-term meteorological patterns is key for informing effective fen restoration planning, particularly with respect to hydrological dynamics. To support this, historical precipitation data over the past 30 years from the closest weather station, Coole (Coolnagun) (Met Éireann - The Irish Meteorological Service), has been compiled to assess seasonal variability in rainfall at the site and surrounding areas.

Two datasets have been visualised: (1) average monthly precipitation (mm) (Figure 3-1), incorporating a 30-year period to show seasonal distribution patterns and (2) minimum/maximum/average annual precipitation (mm) to display long-term rainfall patterns over a 30-year period (Figure 3-1). This information is important to evaluate the feasibility and sustainability of restoration actions aimed at maintaining suitable the hydrological conditions.

The average monthly rainfall is highest in the winter months (October to January) and lowest in late spring (April and May) (Figure 3-2). Minimum rainfall follows the same pattern, while maximum monthly rainfall shows a notable increase in winter.

The average rainfall is relatively similar over the past 30 years with no clear increase or reduction, although significant variations occur between years when looking at the maximum values.

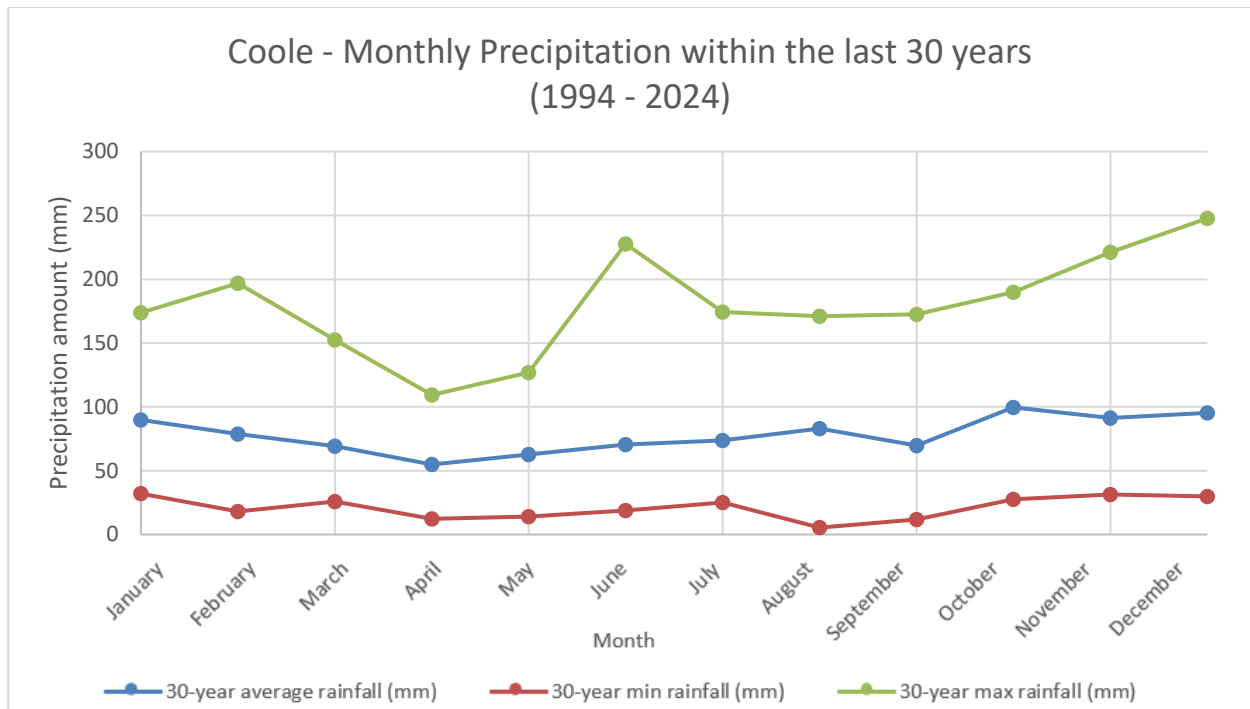


Figure 3-1: Coole (Coolnagun) weather Station – Monthly precipitation amount within the last 30 years (1994-2024)

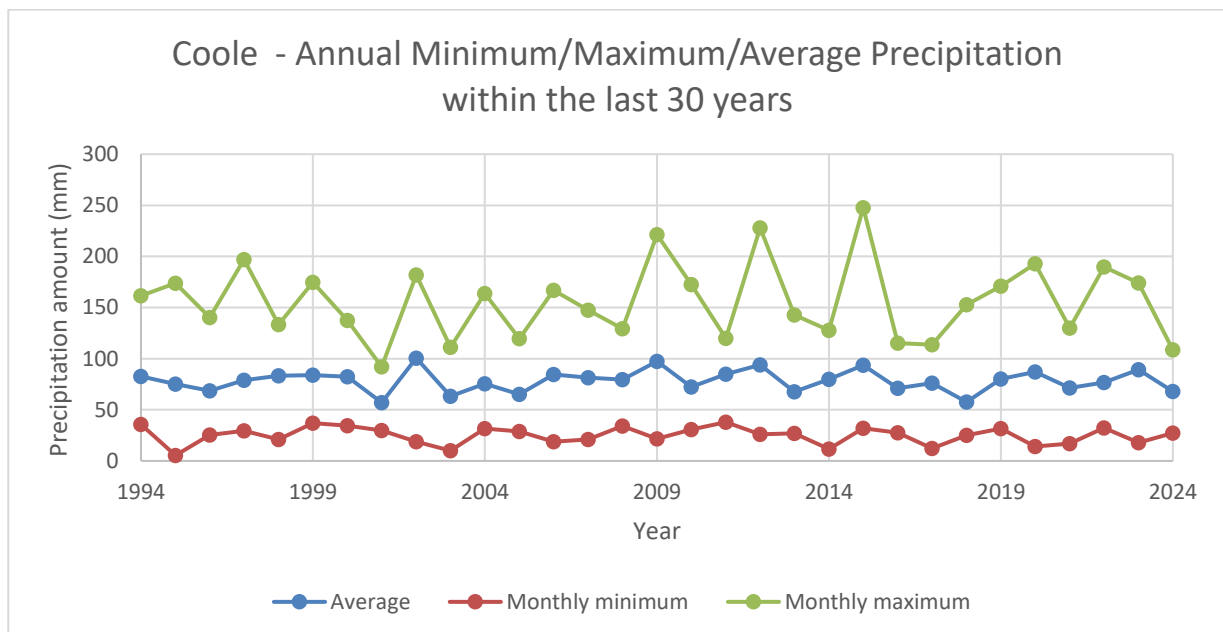


Figure 3-2: Coole (Coolnagun) weather Station – Annual Minimum/Maximum/Average precipitation amount within the last 30 years (1994-2024)

3.1.2 Hydrogeological Setting

The area is underlain by the Lucan Formation characterised by dark limestone and shale. The bedrock geology of the site is presented in Figure 3-3.

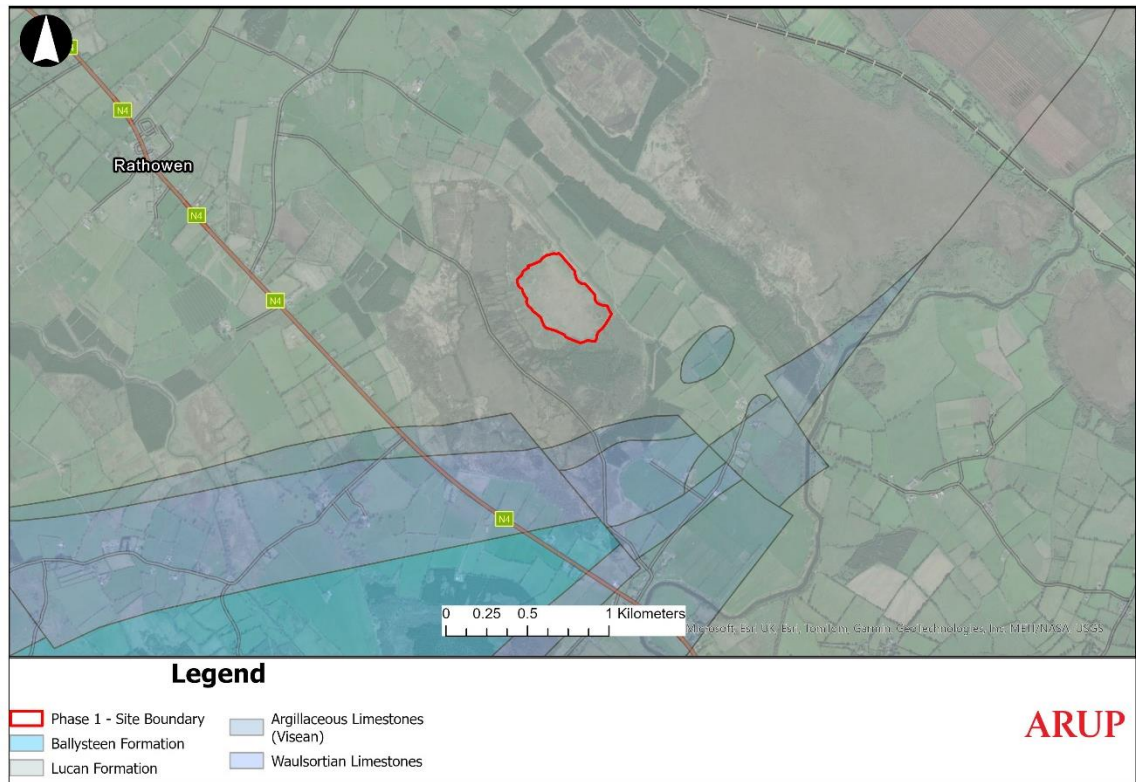


Figure 3-3: Bedrock Geology of Lough Garr (GSI, 2025)

The area is underlain by a Locally Important bedrock aquifer which is Moderately Productive only in Local Zones (LI), where most groundwater flow occurs within the upper 15 m in a weathered and fractured zone. The aquifer classification underlying the site is presented in Figure 3-4.

The GSI (2025) Quaternary sediments map shows the majority of the site as water. The site is bordered by cut-over raised peat, which also occurs within the site boundaries to the south and north-west of the site. A small patch to the north-west of the site is described as till derived from Lower Palaeozoic and Carboniferous sandstones and shales (TLPCSSs) and is also present to the east of the site. The subsoil type underlying the site is presented in Figure 3-5.

According to the Scoping Study and Pilot Survey of Fens (O'Neill et al., 2023) results, the peat depth at Lough Garr is over 3.1m. In addition, from the surveyed area 82.9% was classified as water, 16.5% cut peat, and 0.6% mineral poorly drained (mainly basic).

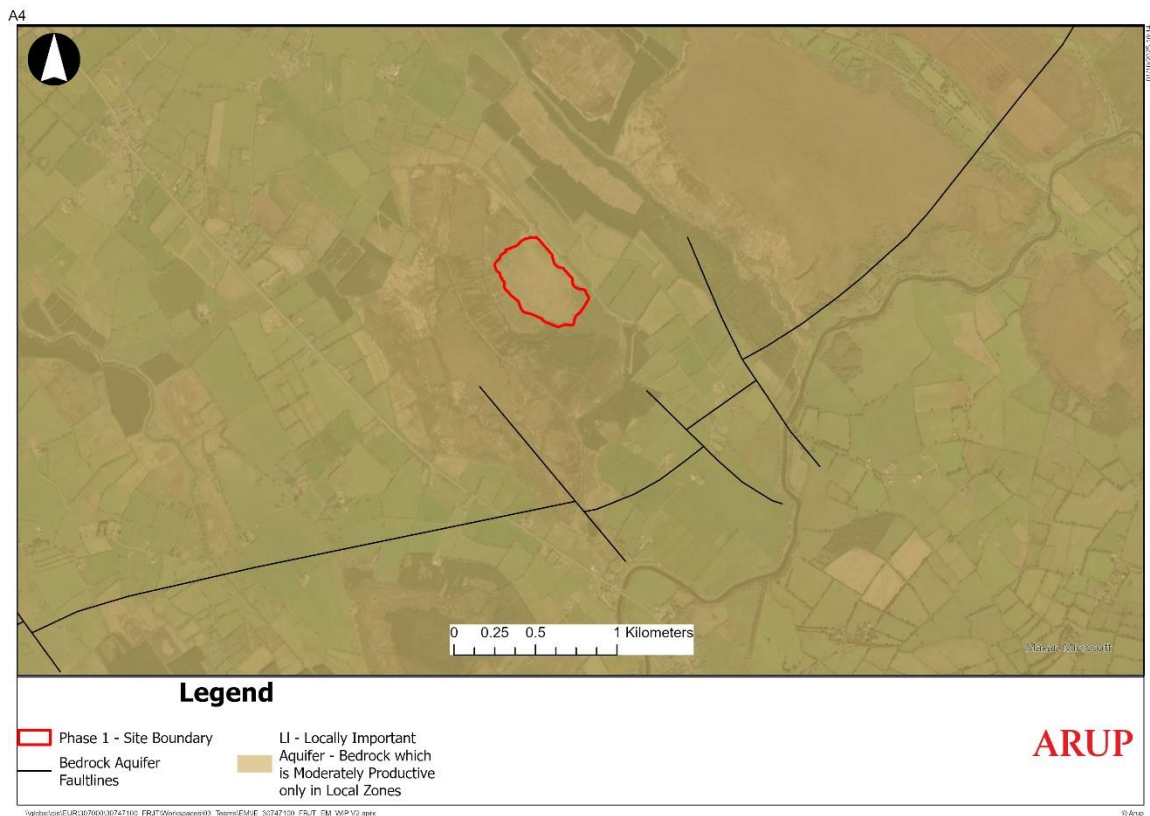


Figure 3-4: Aquifer classification at Lough Garr (GSI, 2025)

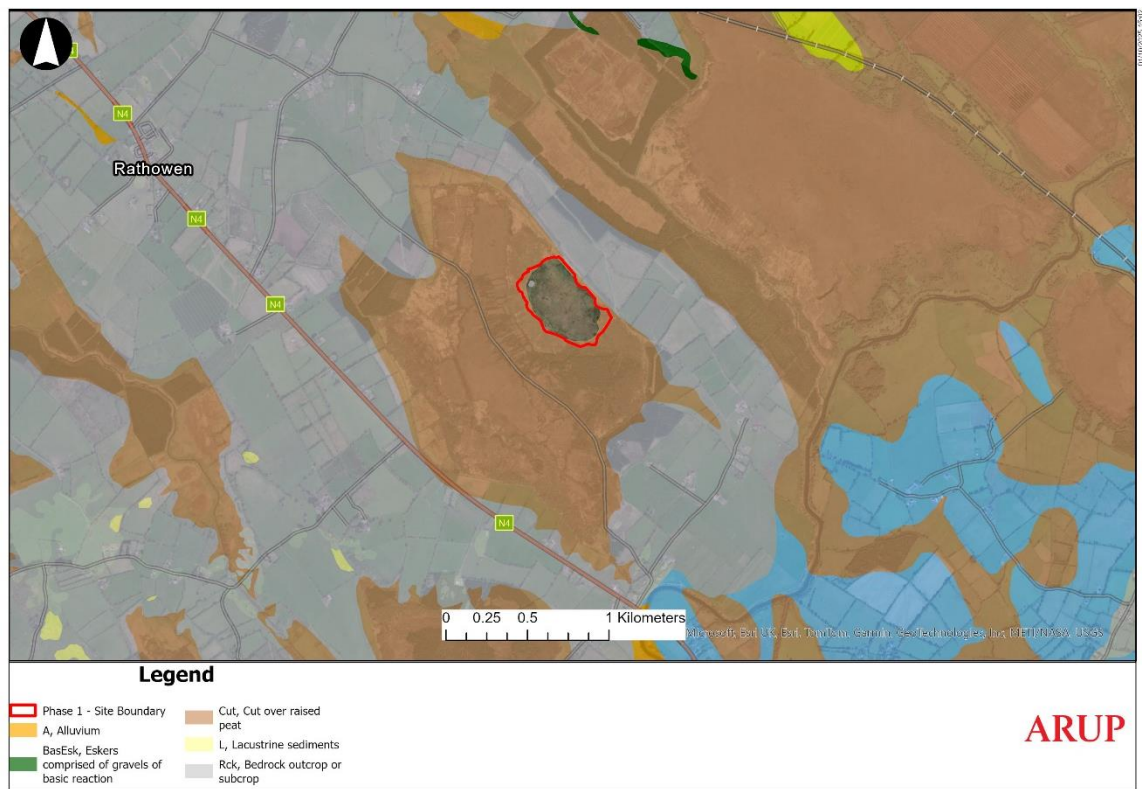


Figure 3-5: Quaternary sediments underlying and surrounding Lough Garr (GSI, 2025)

Groundwater vulnerability in the majority of the site is not mapped since it is classified as water. The groundwater vulnerability is low in areas to the south and north-west within the site boundaries and in the area surrounding the site where cut over raised peat is dominant. The groundwater vulnerability increases to moderate to the east of the site where TLPCSS are present. Similarly, recharge rates are higher in areas where the subsoil is predominantly till (1 to 150 mm/year), and lower in the peat (1 to 50mm/year).

The groundwater vulnerability for the site is presented in Figure 3-6.

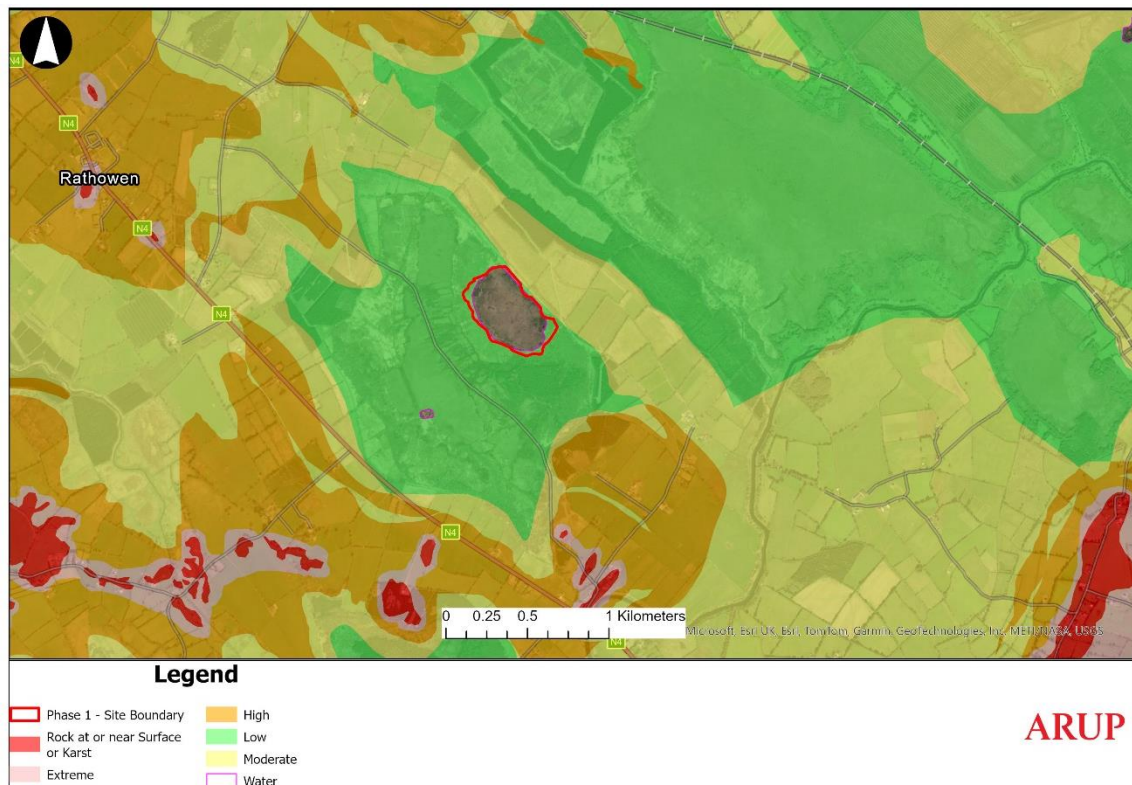


Figure 3-6: Groundwater vulnerability map for Lough Garr (GSI, 2025)

3.1.3 Surface Water Drainage

The site is located within the Upper Shannon Catchment 26F, WFD Sub-catchment Inny (Shannon)_SC_050 (Figure 3-7). The EPA River waterbody body map shows a watercourse, the Garriskil River (Inny_080) which appears to have historically drained the site towards the south-east to the River Inny. It is noted that the EPA river line does not include the drain to the boundary of the site, as it is likely the river line reflects historical drainage of the lake. The Inny_080 is classed as 'Good' WFD Status (EPA, 2024).

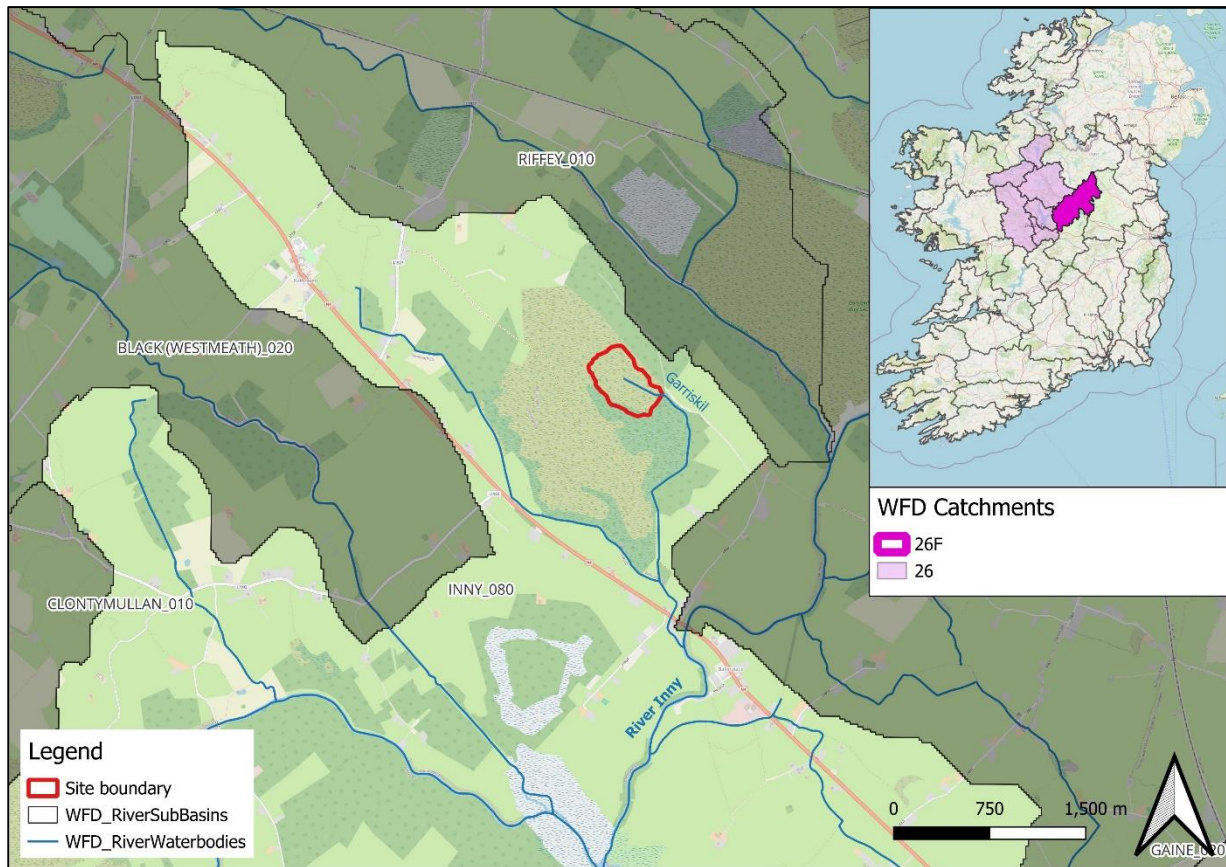


Figure 3-7: Surface water catchment for Lough Garr (EPA, 2025)

The groundwater body underlying Lough Garr is the Inny Groundwater Body (GWB) which extends across Longford, Westmeath, Meath, and Cavan counties, covering approximately 1,384 km² and draining towards Lough Ree via the River Inny. This groundwater body comprises mainly Dinantian limestones and sandstones, with flow generally local and shallow, discharging to the Inny River and nearby lakes. Recharge occurs mainly through rainfall infiltration, particularly where subsoils are thin. Under the WFD, the Inny GWB status (2019-2024) is classed as 'Poor' and 'At Risk' of not achieving WFD objectives (EPA, 2024). This is a decline from previous years assessment of 'Good' status.

The site sits at an elevation of approximately 67m OD and is relatively flat, with higher ground along the boundaries and a slight depression towards the centre (Figure 3-8).

[Insert map showing topography within the site]

Figure 3-8: Topographic (LiDAR) map of Lough Garr NHA [placeholder]

An assessment of historical and current hydrological data indicates that the water regime of Lough Garr has changed over time, primarily due to drainage for peat extraction activities. Historical maps from the early-1800s show an open water body with the site boundary, with a drain passing through the northeast part of the site boundary (Figure 3-9). It seems that the drain was active within the mid-1800's and by the 1840s, the lake area had reduced significantly. By the 1900s there was still a defined input and output to and from the Lake, but in more recent times this seems to have been upgraded by the OPW to be the drain (C32 and C32/1) as part of the Inny Arterial Drainage Scheme. This drain has contributed to the removal of surface water inputs from upstream entering Lough Garr and has drained the lake up to the point where the transitional wetland habitat has formed.

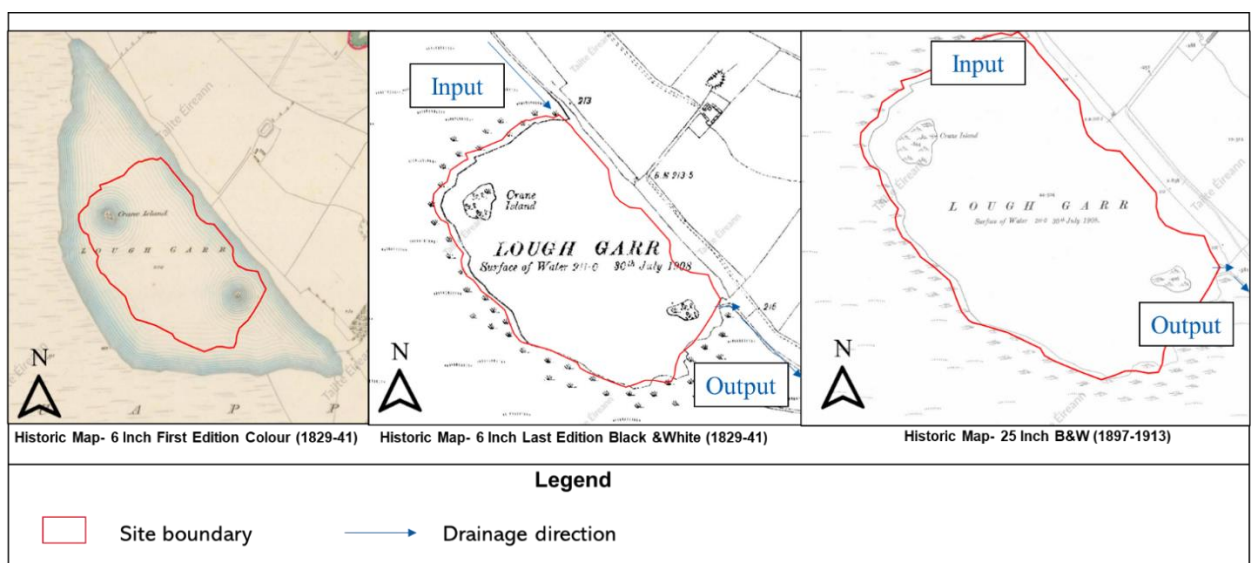


Figure 3-9: Historical water distribution and retention within wetland (Tailte Éireann Historical mapping)

Historically the surface water and spring water inputs from the catchment were directed into Lough Garr. This has changed more recently due to the OPW drain (C32/1) (Figure 3-10). Currently there are no mapped surface water inflows into Lough Garr. Recharge to the site is therefore assumed to be primarily from groundwater, although during rainfall events it is likely that there is a proportion of water entering the fen via overland flow pathways.

al

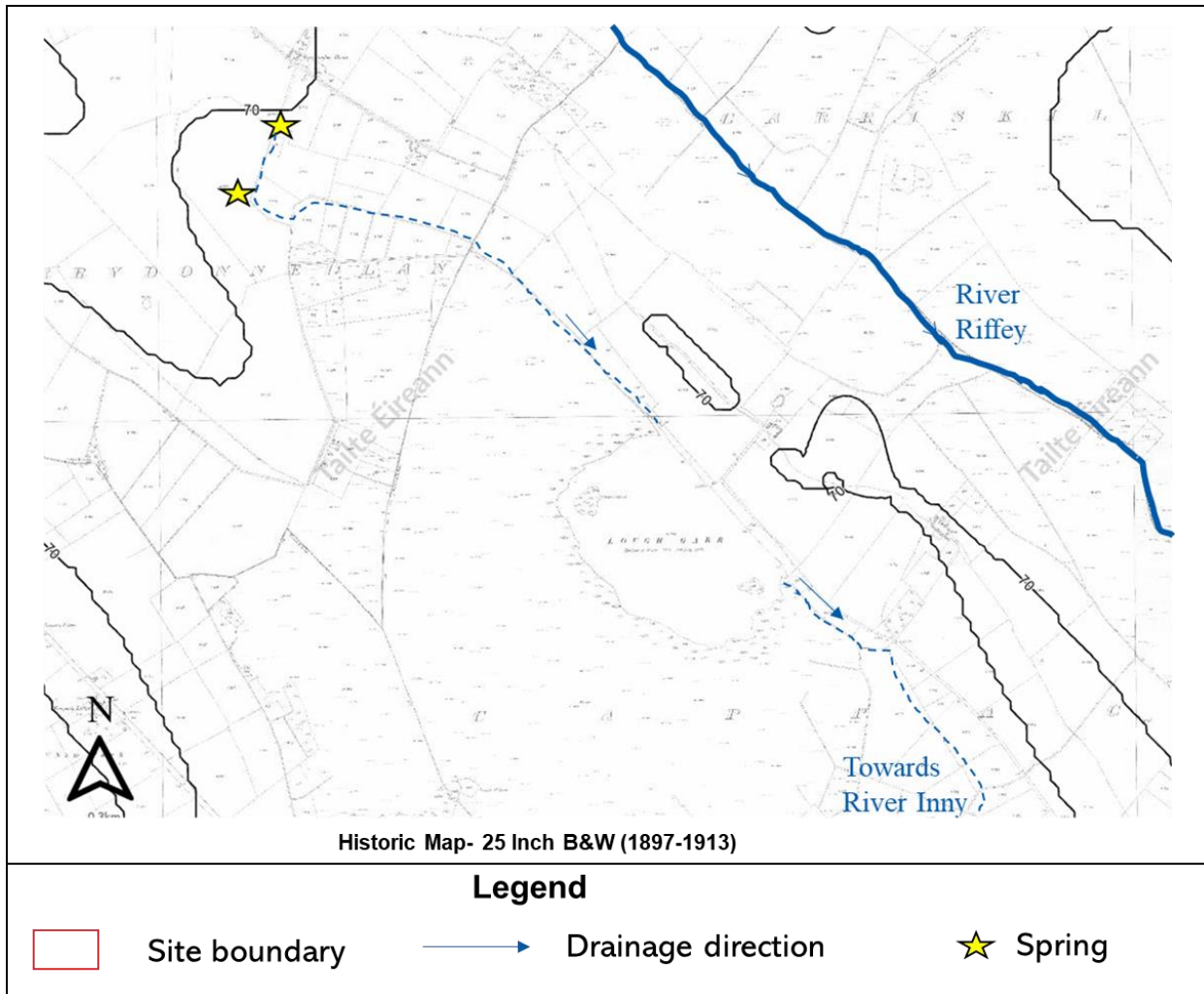


Figure 3-10: Historical upstream contribution to wetland (Tailte Éireann Historical mapping)

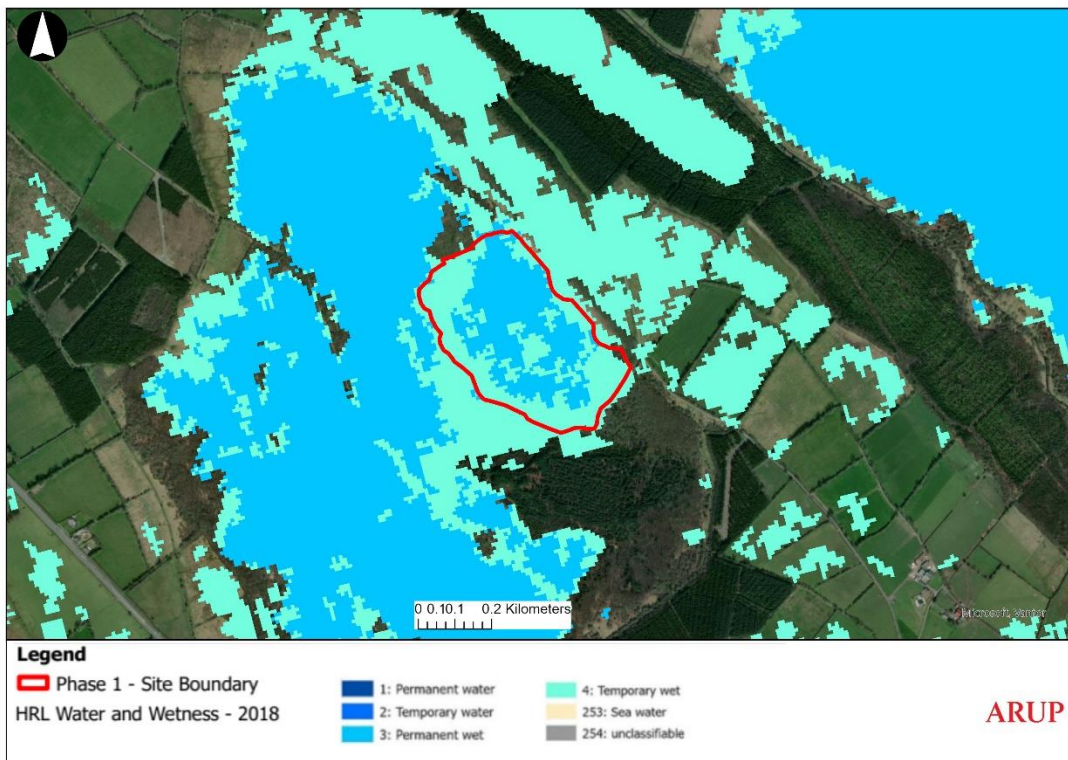


Figure 3-11: HRL Water and Wetness – 2018 (Copernicus, 2025)

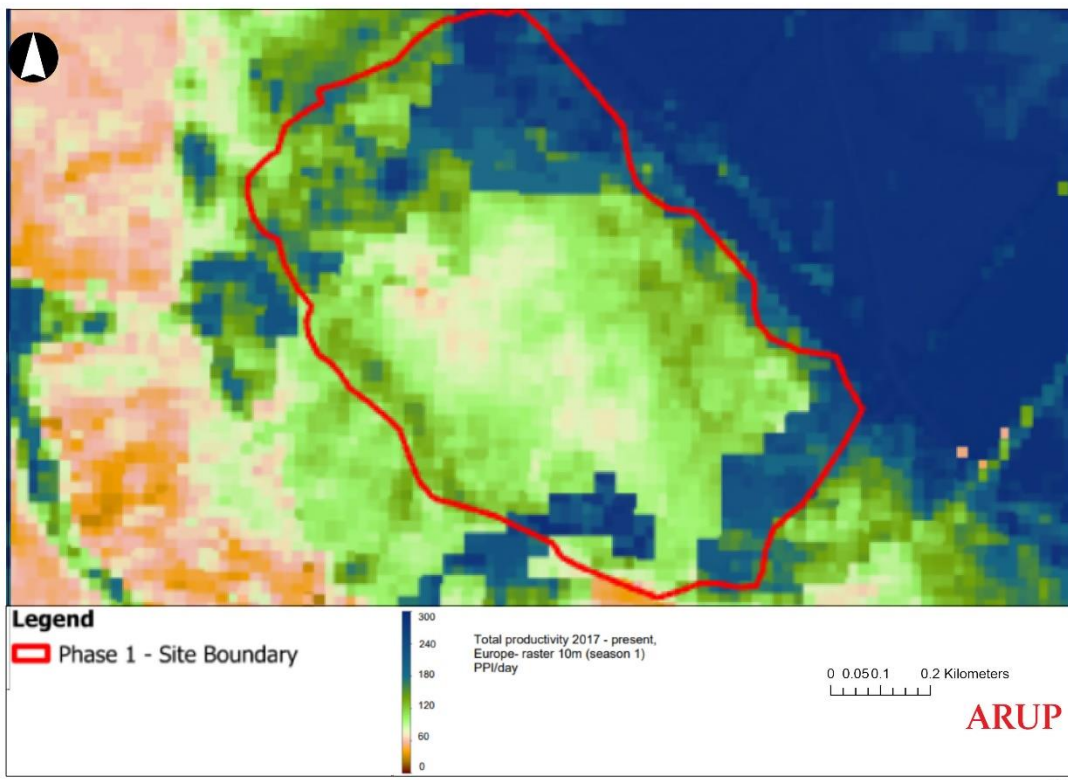


Figure 3-12: Total Productivity 2017 -present, Europe – raster 10m (season 1) (Copernicus, 2025)

Drainage map for Lough Garr following Lidar survey review

Figure 3-13: Mapped drainage network at Lough Garr

3.1.4 Land Use Pressures and Water Quality

The PFS classed Lough Garr as WETMC 3: Buoyant Weakly Minerotrophic Surfaces (‘Transition Bogs’), which is weekly minerotrophic (O’Neil et al., 2023; Weeler, 2009). This means that Lough Garr will receive most nutrients from groundwater in its reference condition. Vegetation will be sensitive to changes in the groundwater quality due to surrounding land use pressure.

Pollution Impact Potential (PIP) maps (EPA, 2025) show the highest risk areas in the landscape for losses of Nitrate and Phosphorus to waterbodies. The PIP models estimate the annual nutrient losses from agricultural land using spatial data on farm management, soil and hydrogeology.

High risk areas for phosphorus loss typically have poorly draining soils and dominant overland flow pathways. The maps indicate that phosphorus delivery flow paths across the site range from low to high risk, with areas of higher risk particularly noted in the southwest, southeast and east of the site (Figure 3-14 and Figure 3-15). A small area in the northwest is classified as low risk. There are potential preferential pathways identified to the east and north of the site which may provide a pathway towards the fen. These locations may be targeted for restoration measures in this FRP.

Freely draining soils and substantial groundwater pathways are high risk for nitrate losses. The risk of nitrate loss is generally low across the northwest, northeast and east of the site (Figure 3-16). In contrast, the southwest and southeast area, may represent a more vulnerable zone for nitrate loss.

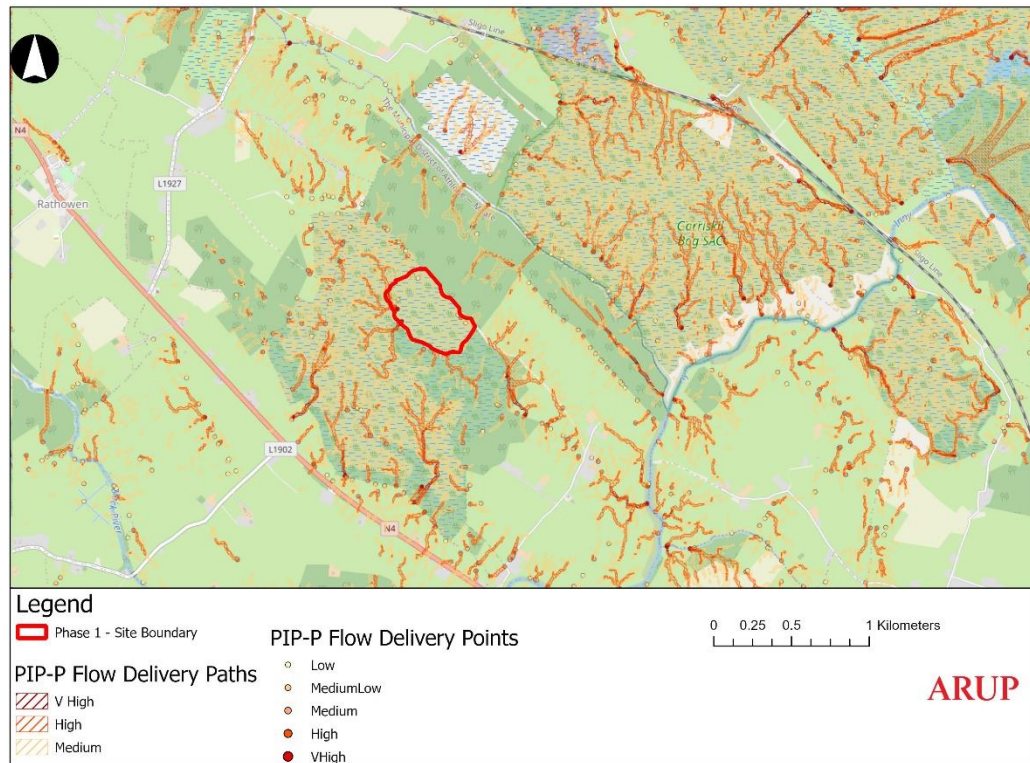


Figure 3-14: PIP- P - Flow delivery paths and points for Phosphorus at Lough Garr (EPA, 2025)

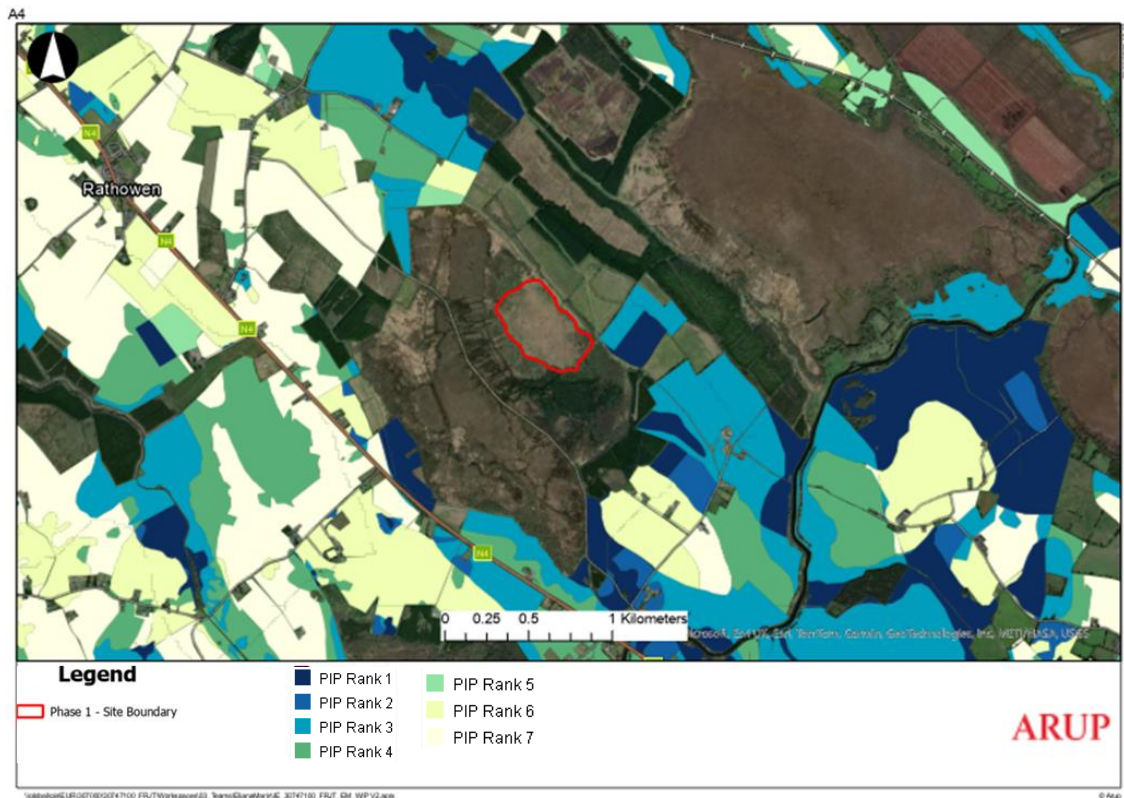


Figure 3-15: Pollution Impact Potential – Phosphorus (PIP-P) at Lough Garr (EPA, 2025)

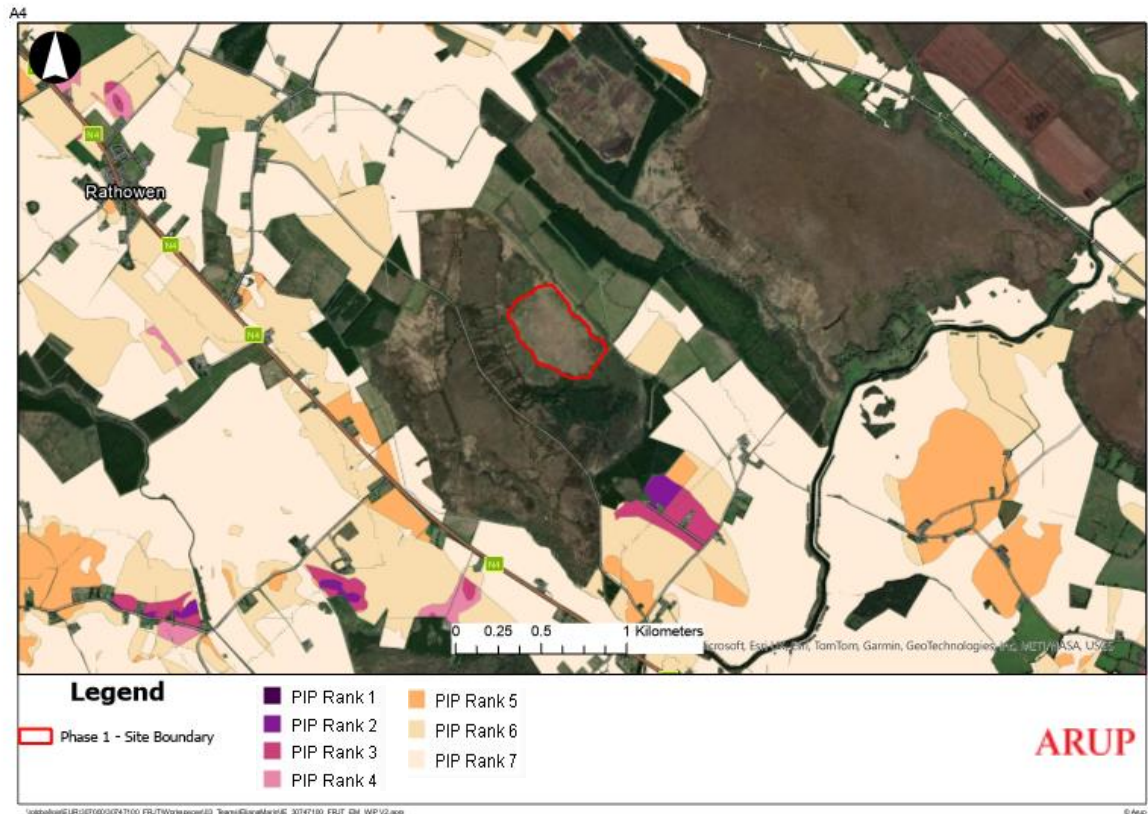


Figure 3-16: Pollution Impact Potential -Nitrate (PIP-N) at Lough Garr (EPA, 2025)

3.2 Field Survey

Site monitoring was undertaken in October and November 2025, focusing on developing the understanding of the water regime, pressures and implementation of restoration measures within the site. The site monitoring included peat depth probing, water quality monitoring, groundwater level monitoring in piezometers and observations of water flow in the drainage network.

Water quality data were collected in the drain to the east of the site. The parameters recorded included pH, electrical conductivity (EC), temperature, dissolved oxygen (DO), nitrate, and phosphate. Groundwater levels were monitored in selected piezometers to the west of the site, and peat depths were probed to assess substrate characteristics.

Monitoring locations are presented in Figure 3-17.

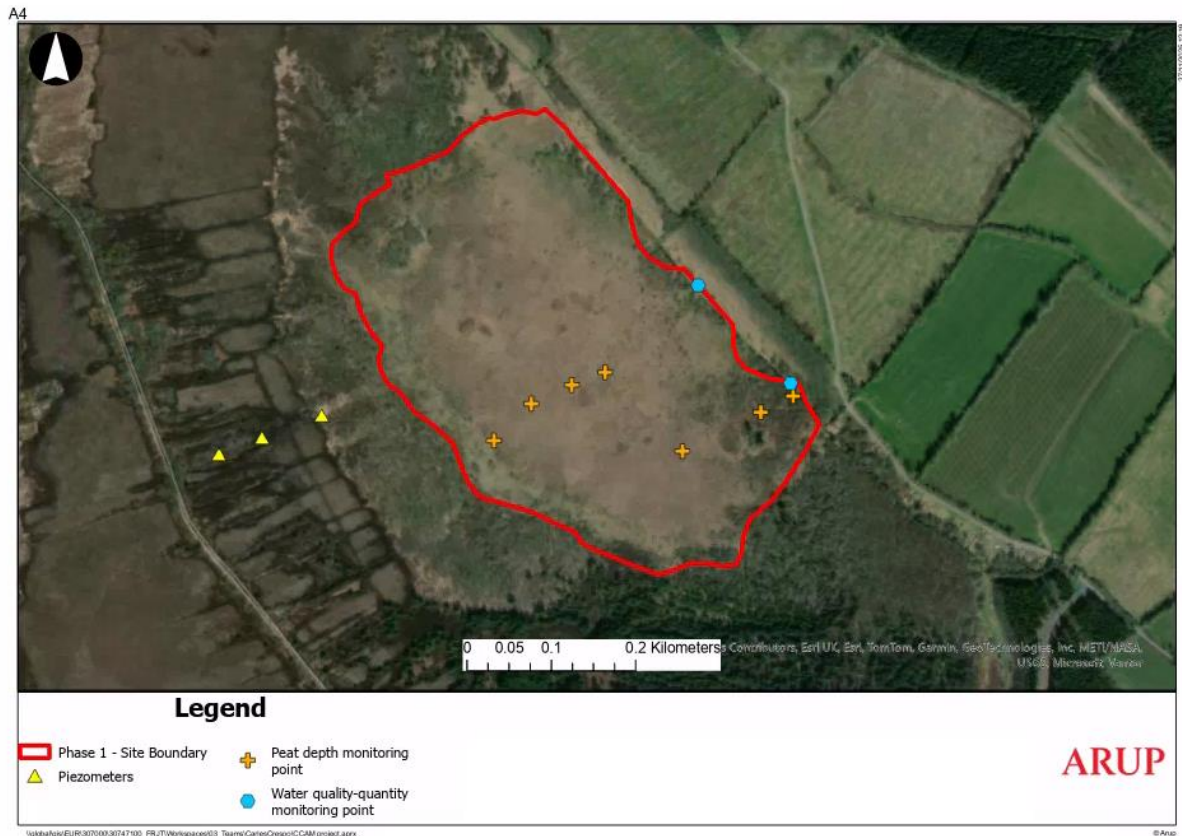


Figure 3-17: Peat depth, water quality/quantity and piezometer monitoring points

3.2.1 Peat Depth Probing and Ground Investigations

Peat depth probing across the site showed spatial variability. The central area has deep peat, exceeding 4 m. In the south and south-east, peat depths are more variable, ranging between 2–3 m. Along the existing drain, peat is shallower, ranging from 1 m to approximately 0.4 m.

Peat depths results obtained during the site surveys are shown in Figure 3-18.

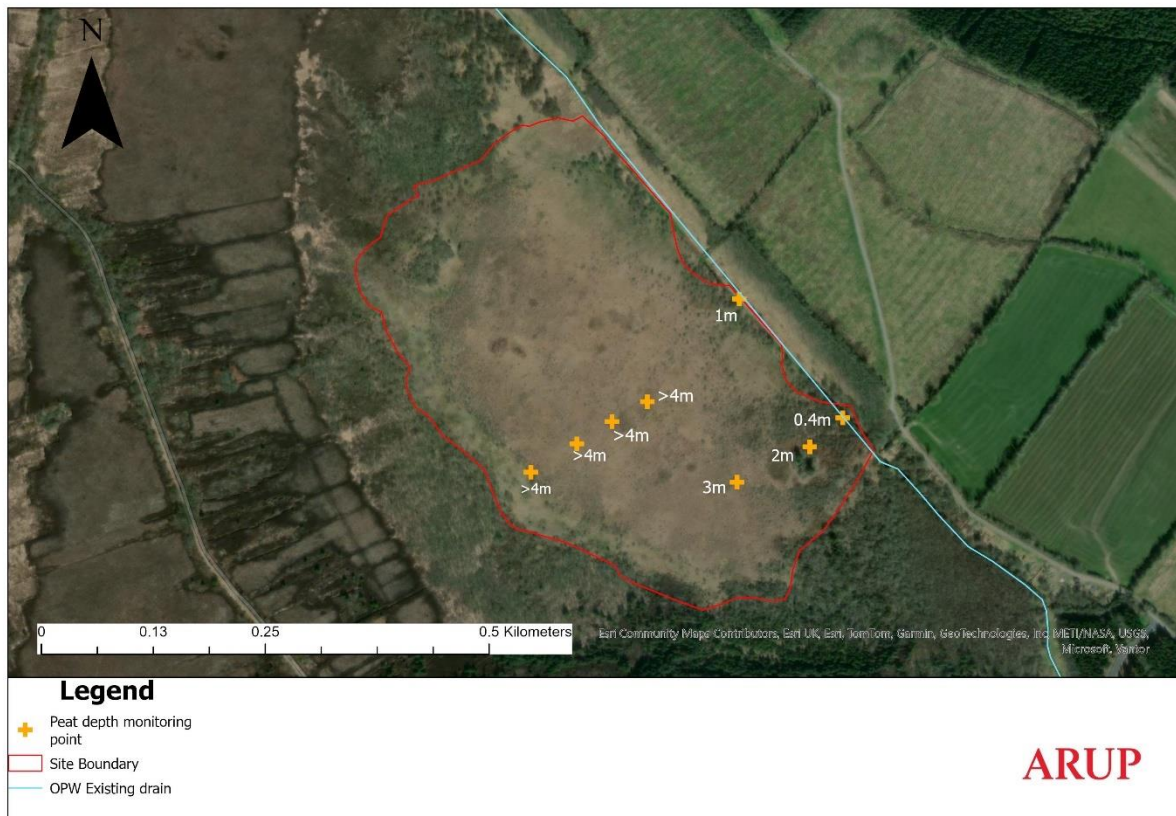


Figure 3-18: Monitoring results for peat depth at Lough Garr

3.2.2 Groundwater Levels and Springs

EPA maps do not indicate any wells or springs around the site area. No springs or surface flushes were observed within the site during the walkover.

Several piezometers were identified during the site visit to the west of the site, outside the site boundaries. These are also outside the Coillte boundaries, and their ownership is unknown at this stage. The location of the piezometers monitored, and the water depth results from the site visit surveys are shown in Figure 3-19.

Groundwater levels were measured with water depths ranging from 0.17 m to 0.14 m below existing ground level, reducing to 0 m at the point closest to the fen. Ground levels across these locations are generally flat. The observed trend indicates a rising water table towards the fen.

3.2.3 Surface Water levels

Surface water conditions varied across the site, particularly with respect to flow regimes and drainage features. Along the northern boundary, the existing drain recorded an average water depth of approximately 0.75 m during the site visits. No visible flow was observed, and the water appeared stagnant.

In the southeastern area, water had overtopped the drain bank, resulting in ponding on the adjacent land, with depths of approximately 0.3 m. This appears to be caused by a blockage linked to a change in slope within the drain.

The points where water quality parameters, and the water levels were reviewed are presented in Figure 3-19, together with the results from the site visit surveys.

Review of ground level data indicates an upward gradient within the drain towards the southeastern part of the site, creating a localised dip in the drain that retains water and prevents flow. Dense vegetation in this section further restricts conveyance.

Downstream of the site boundary, water flows towards the southeast. This is attributed to:

- A downward change in slope.
- Reduced vegetation within the channel.
- The presence of a tributary drain from the northern agricultural fields, which joins the main drain and contributes additional flow.

Surface water levels are presented in Figure 3-19.

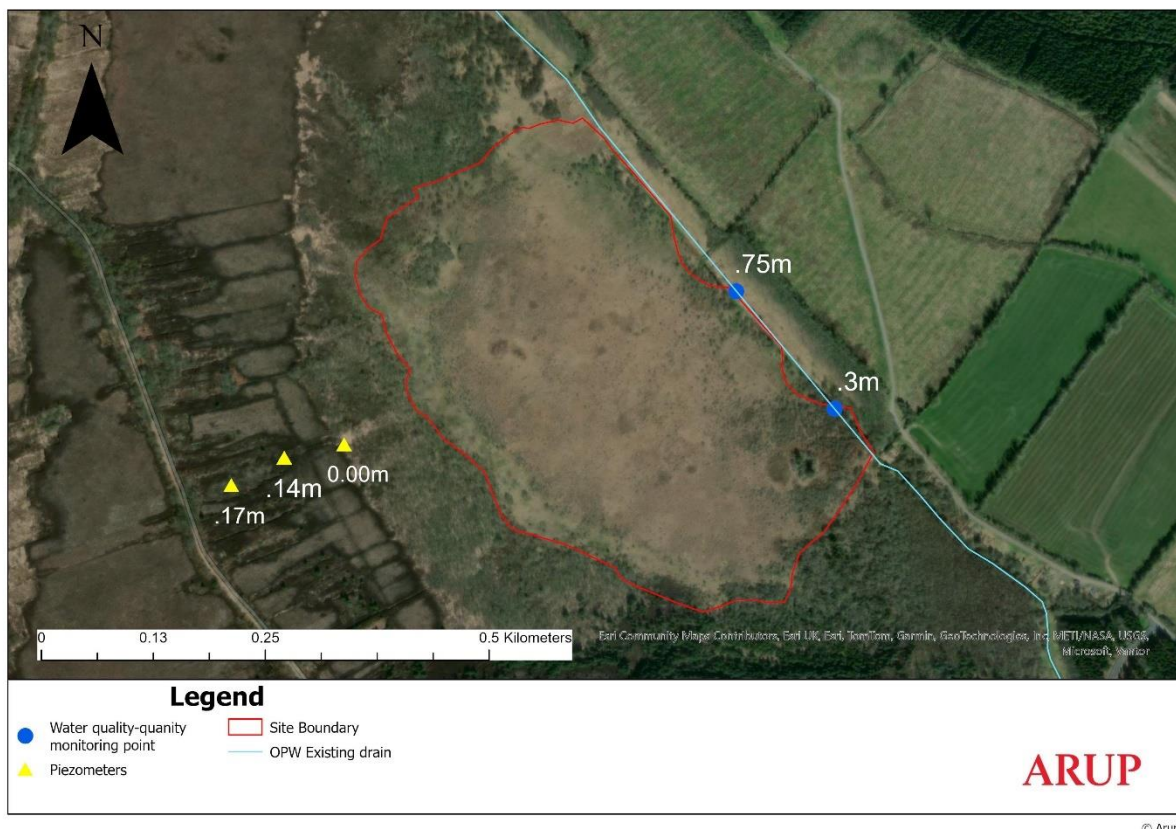


Figure 3-19: Monitoring results for surface water and groundwater level at Lough Garr

3.2.4 Water Quality

A potential source of nutrient enrichment across the site is the forest managed by Coillte in the northern part of the site boundary, agricultural activity and the presence of livestock. Phosphate concentrations (PO_4) along the existing drain remained constant at 0.09 mg/L, below the good status environmental quality standard of 0.107 mg/L PO_4 (0.035 mg/L $\text{PO}_4\text{--P}$)⁴ (Figure 3-20). Further monitoring is required to assess seasonal variations of water quality in relation to upstream forestry activity.



Figure 3-20: Monitoring results for Phosphate (PO_4) at Lough Garr

Nitrate ($\text{NO}_3\text{--N}$) across the site is below the regulatory groundwater threshold of 8.5 mg/L $\text{NO}_3\text{--N}$ (37.5 mg/L NO_3) (Figure 3-21). Although there is no regulatory surface water threshold, mean concentrations above 1.8 mg/L $\text{NO}_3\text{--N}$ (8 mg/L NO_3) could affect river ecological health (EPA, 2025b). At the northern part of the drain, nitrate levels are 1.07 mg/L $\text{NO}_3\text{--N}$ (4.5 mg/L NO_3), reducing to 0.32 mg/L $\text{NO}_3\text{--N}$ (1.6 mg/L NO_3) further south. This suggests minor nutrient enrichment in the northern section, likely from the stagnant water near the Coillte forest. Levels remain below environmental thresholds, confirming good environmental quality.

⁴ Government of Ireland (1998) S.I. No. 258/1998 — Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations 1998. Available at: <https://www.irishstatutebook.ie/eli/1998/si/258/made/en/print>

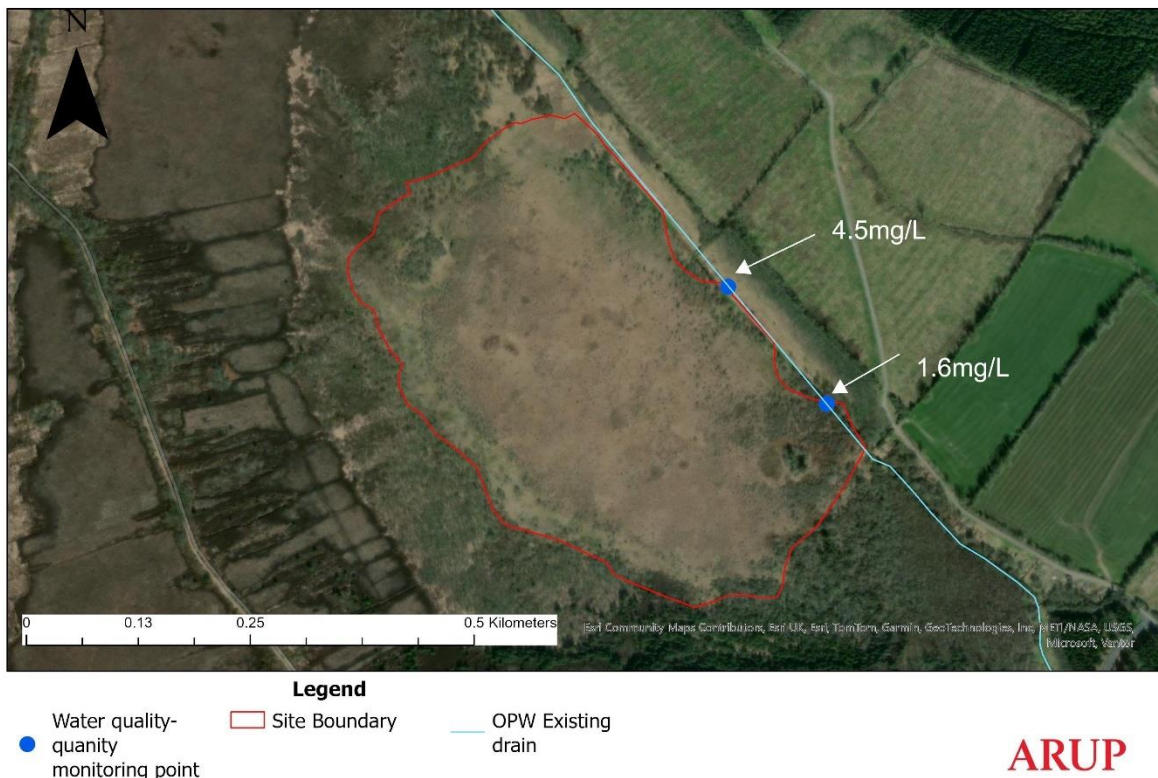


Figure 3-21: Monitoring results for Nitrate (NO₃-N) at Lough Garr

pH and electrical conductivity (EC) were also measured at the monitoring points, with readings taken first in the northern part of the drain and then in the southern section. pH values were consistent across the site, ranging from 7.05 to 7.17, indicating neutral conditions. Electrical conductivity values ranged from 487 $\mu\text{S}/\text{cm}$ in the northern section to 436 $\mu\text{S}/\text{cm}$ in the southern section.

Water quality monitoring does not show any significant spatial variation. Further water quality monitoring is recommended to establish potential trends.

3.3 Conceptual Site Model

Lough Garr is classed as an Ombrogenous bog (WETMC 3b: Buoyant Weakly Minerotrophic Surfaces ('Transition Bogs') in an open basin (O'Neil et al., 2023; Weeler, 2009). Key characteristics of the site are:

- The topography of the site is relatively flat, with higher ground along the boundaries and a slight depression towards the centre.
- The site is underlain by cutover bog peat and till derived from Lower Palaeozoic and Carboniferous sandstones and shales. Beneath these deposits lies a Locally Important Aquifer – Bedrock that is Moderately Productive only in Local Zones (LI). Groundwater flow is largely confined to the upper 15 metres, within the weathered and fractured bedrock zone. Recharge of this aquifer occurs mainly through rainfall infiltration.

- The site is mainly rainfall fed, reflected in the seasonal water level changes. As described in the PFS, evidence such as the height of lichens on trees and bushes indicates that the entire transition mire becomes inundated during winter, when water levels rise approximately 0.5 m above those recorded during the survey.
- Water movement predominantly entering the fen through overland flows and from the groundwater inflow.
- There is limited association with a watercourse (EPA: Inny_080 or OPW Drain: C32/1) which would have historically drained the site towards the south-east to River Inny. The retention of water within drain creates a hydraulic gradient for the fen. and helps to maintain water levels.

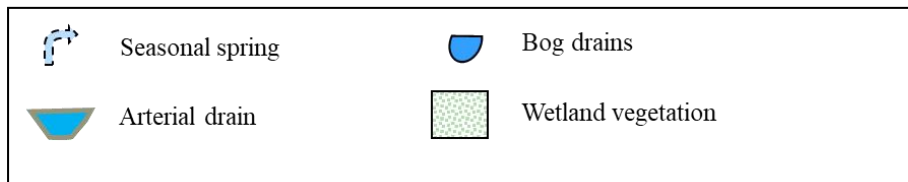
The CSM is presented Figure 3-22.

Lough Garr Fen Restoration Plan

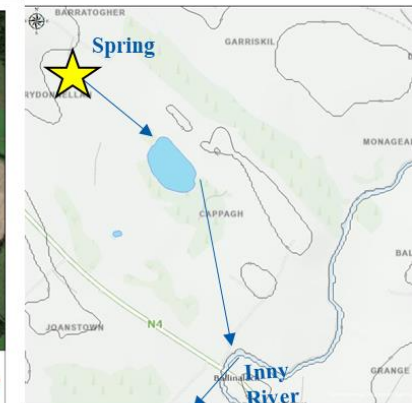
Lough Garr
Westmeath County
26F Upper Shannon

WETMEC: 3: Buoyant Weakly Minerotrophic Surfaces ('Transition Bogs')

Water key:



Vegetation:



Conceptual site model:

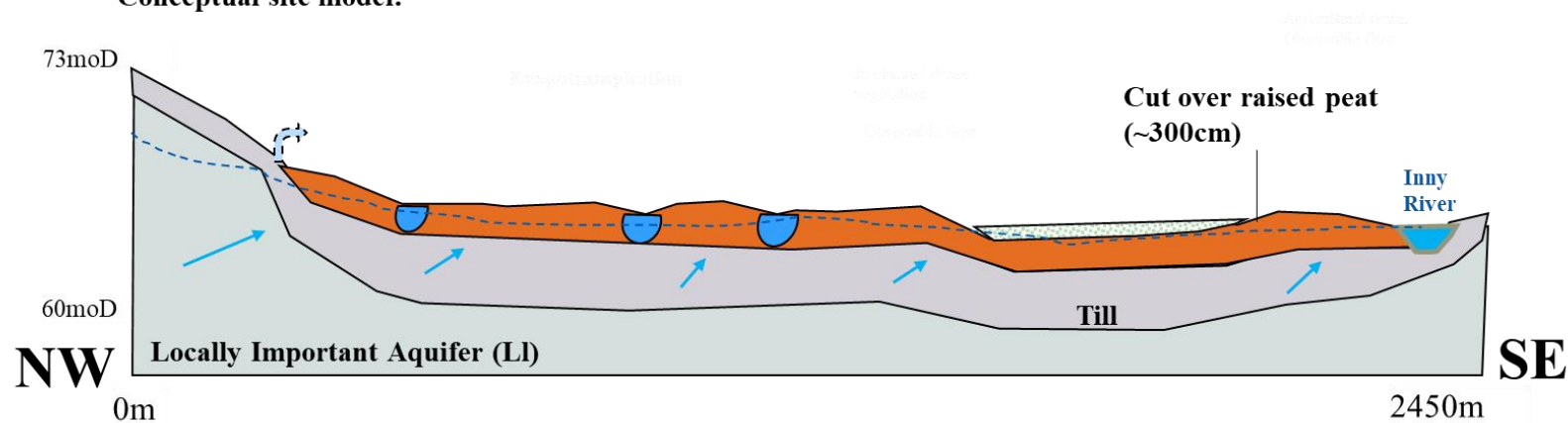


Figure 3-22: Conceptual Site Model (CSM) – Lough Garr

4 Ecology

4.1 Desk Study

A review of available desktop information on the ecological baseline for Lough Garr NHA was reviewed from the below information sources:

- NPWS Protected Sites – Natural Heritage Areas – Lough Garr (Westmeath) NHA;
- NPWS Article 17 habitats distribution datasets;
- Scoping Study and Pilot Survey of Fens (O'Neill, et al., 2023);
- Biodiversity Maps - National Biodiversity Data Centre (NBDC);
- Plant Atlas 2020 website - Botanical Society of Britain & Ireland (BSBI);

The 'Scoping Study and Pilot Survey of Fens' (PFS) was commissioned to develop and test a standardised methodology for assessing the conservation status of fen habitats across Ireland. As part of the PFS, Lough Garr NHA in County Westmeath was selected as one of the pilot sites for field survey. The site was surveyed in May 2020, with a focus on wetland habitats, including any which were distinguished as Annex I quality. The study confirmed the presence of Annex I-quality 7140 Transition mires on the site, along with adjacent areas supporting other Annex I-quality habitats, including 7110 Active Raised Bog, 91D0 Bog Woodland, and 91E0 Alluvial Forest.

The survey methodology included:

- Detailed vegetation assessments using quadrats to record species composition and structure.
- Hydrological observations such as water levels and flow.
- Documentation of disturbance indicators including drainage, grazing, and invasive species.

GPS mapping and photographic records were also used to support habitat boundary delineation and condition assessment. While the primary emphasis was on habitat quality, vascular plants and bryophytes were recorded as part of the vegetation surveys, contributing to an understanding of species diversity and habitat integrity at the site.

4.1.1 Habitats

The habitats summarised below for the Annex and non-Annex habitats are based on the findings of the Scoping Study and Pilot Fen Survey (PFS) (see Appendix B –). Two habitat classification systems were used: Annex I codes⁵ (EU Habitats Directive) for legally protected habitats and Fossitt codes (Irish habitat classification) for broader ecological context. Annex I habitats are distinguished by their conservation importance and presence of indicator species such as *Schoenus nigricans* and *Carex davalliana*, which signal high-quality fen conditions.

Situated within the PFS boundary for Lough Garr, the site is predominantly characterised by Annex quality 7140 Transition mire, forming a mosaic with neighbouring habitats such as raised bog, wet woodland, and swamp. The area is small and exhibits relatively undisturbed characteristics. Adjacent habitats include FS1 Reed and large sedge swamps, WD2 Mixed broadleaved/conifer woodland and the Annex I quality habitats 7110 and 91E0.

4.1.1.1 Annex I Quality Habitats

The following Annex I quality habitats were identified and mapped as part of the PFS:

- **7140 Transition mires** – Covering 14.35 ha. There is natural gradation into surrounding habitats such as bog, wet woodland and swamp. The main species in the transition mire are *Carex rostrata*, *C. diandra*, *Equisetum fluviatile*, *Calliergonella cuspidata* and *Calliergon cordifolium*. The future prospects of this habitat at Lough Garr are scored as Unfavourable-Inadequate due to the presence and risk of continuing scrub encroachment, with minor nutrient enrichment and ditch infilling also noted as pressures/threats to the site in general.
- **7110 Active raised bogs** – Existing in a mosaic with the 7140 Transition mire (approximately 1.19ha), this occurs on the western border of the site consisting of *Sphagnum* lawn and *Vaccinium oxycoccos*.
- **91E0 *Alluvial forests** with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) - Covering 1.62 ha. Predominantly located along the eastern boundary of the site, in addition to a small area to the northwest.

4.1.1.2 Non-Annex/Fossitt habitats

Non-Annex fen and other habitats were also recorded and mapped within the site, with mapping based on Fossitt (2000) classification. Habitats within Lough Garr were noted to largely occur in mosaic with one another. These include:

⁵ While Annex I habitats are legally protected under the EU Habitats Directive, the term ‘Annex I quality habitat’ simply indicates that the habitat is in good ecological condition and does not confer any additional legal protection.

*Priority habitat under the EU Habitats Directive

- PF3 - Transition mire and quaking bog.
- PB1 - Raised Bog
- WN6 - Wet willow-alder-ash woodland

These habitats were distributed across the site, with PF3 Transition mires and quaking bog dominating the site alongside isolated patches of WN6 Wet willow-alder-ash woodland.

- **PF3 Transition mires**

Dominant habitat on site, mostly of Annex I quality 7140. Species include species in the transition mire are *Carex rostrata*, *C. diandra*, *Equisetum fluviatile*, *Calliergonella cuspidata* and *Calliergon cordifolium*

- **PB1 Raised bog**

A mosaic of PB1 exists along the western area of the site. Species include *Sphagnum* sp and *Vaccinium oxycoccos*.

- **WN6 Wet willow-alder-ash woodland**

Exists within the site as isolated patches along the eastern border as well as in one patch in the north-west of the site.

Overall, the non-Annex and Fossitt habitats show a high degree of diversity and ecological connectivity, though some areas are impacted by scrub encroachment.

Several categories of the Irish Vegetation Classification (IVC) were recorded on site during the PFS, primarily within the transition mire habitat. The IVC is a system for classifying plant communities in Ireland based on species composition and ecological characteristics, providing a finer-scale understanding of vegetation structure than habitat-level classifications. Two categories of the Irish Vegetation Classification (IVC) were recorded on site:

- FE2D - *Carex rostrata* – *Menyanthes trifoliata* mire / Bottle Sedge – Bogbean mire
- FE2F - *Menyanthes trifoliata* – *Sphagnum recurvum* agg. Mire / Bogbean – Flat-topped Bog-moss mire

4.1.2 Species

The following subsections outline the presence of species recorded at or within the zone of influence of the Lough Garr site. This includes protected species listed under relevant legislation and conservation frameworks such as the EU Habitats and Birds Directives (Annex I, II, IV, and V), the Irish Red Lists, and the Wildlife Acts (including species protected under the Flora Protection Order). Where available, maps of recorded sightings will be provided to support spatial understanding of species distribution. Records are limited to those from the past ten years, reflecting the most plausible timeframe for continued presence and ecological relevance to the site.

4.1.2.1 Species Within the Site

A review of species records from the NBDC showed that limited site records exist, with only three species records within the last ten years. These records include the brown hawker dragonfly *Aeshna grandis* and the Tortoise Bug *Eurygaster testudinaria*. The third record is of rigid bog-moss *Sphagnum teres* in 2020. This species is a protected under the Habitats Directive as an Annex V species and on a national level is listed as ‘Least Concern’ under the IUCN Conservation Status. The species is associated with base rich environment including PF1 rich fen and flush and PF3 Transition mire and quaking bog, the latter of which is present on site. The record is from the southern section of the site, overlapping with PF3 Transition mire and quaking bog.

During the initial survey of the site as part of the PFS pilot project in 2020, several invertebrate species were recorded on site (see Table 4-1 below). Also recorded was the rigid bog-moss *Sphagnum teres* – which had previously been confirmed by NBDC records that year.

Table 4-1: List of invertebrate species observed during the PFS Pilot Survey

Common Name	Latin Name	Notes
Species of caddisfly, no common name.	<i>Tricholeiochiton fagesii</i>	Second adult record for Ireland, first male adult recorded in Ireland.
Marsh fritillary	<i>Euphydryas aurinia</i>	Red list – Vulnerable Annex II species (Habitats Directive)
Peacock butterfly	<i>Aglaia io</i>	Red list – Least concern
Orange-tip butterfly	<i>Anthocharis cardamines</i>	Red list – Least concern
Speckled wood butterfly	<i>Parage aegeria</i>	Red list – Least concern
Emperor moth	<i>Saturnia pavonia</i>	Red list – Least concern

4.1.2.2 Species within the Zone of Influence

The following protected functionally linked species were recorded within the 2km zone of influence around the Lough Garr site within the last ten years from the NBDC (See Table 4-2 below)

Table 4-2: Functionally linked, protected species records within the Zone of Influence of the Lough Garr site

Legislative Protection	Common Name	Latin Name
Birds Directive	Lapwing	<i>Vanellus vanellus</i>
Birds of Conservation Concern Ireland (Red list)	Meadow pipit	<i>Anthus pratensis</i>
Birds of Conservation Concern Ireland (Amber list)	Skylark	<i>Alauda arvensis</i>
	Sparrowhawk	<i>Accipiter nisus</i>
Irish Red list of Macro-moths (Near threatened)	Yellow shell	<i>Camptogramma bilineata</i>
Habitats Directive (Annex IV)	Daubenton’s bat	<i>Myotis daubentonii</i>
	Leisler’s bat	<i>Nyctalus leisleri</i>
	Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>

Legislative Protection	Common Name	Latin Name
Habitats Directive (Annex II)	Otter	<i>Lutra lutra</i>
Wildlife Acts	Badger	<i>Meles</i>
	Hedgehog	<i>Erinaceus europaeus</i>
	Irish hare	<i>Lepus timidus hibernicus</i>
	Pine marten	<i>Martes martes</i>

4.2 Field Survey

Following a comprehensive review of available desktop data, a targeted follow-up ecological survey was undertaken on the site in August 2025. The field surveys concentrated on key areas highlighted during the desk-based assessment, specifically those with potential for restoration activities. These locations were investigated in detail to verify and further assess ecological conditions and parameters, ensuring that any recommended restoration measures would be both appropriate and effective in the identified zones.

Three survey forms were created to collect data relevant to:

- Pressures and threats
- Monitoring data

4.2.1 Monitoring Points

To inform the restoration strategy for Lough Garr, a targeted walkover survey was undertaken. This was a focused assessment designed to gather site-specific data at pre-identified locations. The walkover was designed to assess ecological condition at ten pre-identified monitoring points, selected based on hydrological features, habitat potential, and restoration feasibility. The locations were determined through expert discussion and review of baseline data and will serve as fixed monitoring stations post-restoration.

These monitoring points now serve a dual purpose:

- Baseline characterisation of current site conditions.
- Long-term monitoring stations to assess ecological change following restoration.

The surveys focused on two key components:

- Target Notes: Qualitative observations at each monitoring point, capturing site condition, vegetation structure, hydrological features, and legacy management.
- Pressures and Threats Identification: Systematic recording of anthropogenic and natural pressures affecting each location.

The surveys confirmed the presence of a single fen habitat type:

- Annex quality 7140 Transition mire: Present at all three monitoring points.

4.2.2 Pressure & Threats

This section outlines the historical and current pressures and threats affecting fen habitat at Lough Garr, with emphasis on the Annex I quality habitat 7140 Transition Mires. The analysis draws on baseline data from the PFS (O'Neill, et al. 2023) and recent ecological walkovers.

4.2.2.1 7140 Transition Mires

Historical Pressures

The PFS identified the following pressures affecting the transition mire habitat at Lough Garr:

- Scrub encroachment, leading to shifts in species composition and a decline in characteristic mire vegetation.
- Minor nutrient enrichment, with minor algae cover being recorded in one area.
- Drainage, both historical and ongoing, which lowers water tables and disrupts mire hydrology.

Current Observations

Walkover surveys confirm that these pressures continue to shape the condition of transition mire habitat at Lough Garr.

- **Drainage** remains a prominent feature, with multiple ditches noted on site. One drain, approximately 456 meters long, was mapped on the eastern boundary of the site and contained species such as *Agrostis stolonifera*, *Holcus lanatus* and *Phragmites australis*. Identified as an arterial drained formed by the OPW, it is largely infilled with vegetation and non-functional however, its presence indicates significant past hydrological modification.
- **Scrub encroachment** is evident, with willow and birch scrub common across the site. Whilst this is considered a potential threat to the future prospects of the transition mire habitat site if left unmanaged, currently it is not deemed significant as they do not form closed canopy over the fen. If drier conditions were to occur on the site, scrub could encroach further into the identified transition mire and raised bog habitats.

General Site Observations

The habitat at Lough Garr consists predominantly of transition mire and quaking bog and, while subject to a range of pressures that threaten the future prospects and overall status of the site, is currently in a relatively stable and condition. However, both the present and historical pressures of scrub encroachment, drainage and nutrient enrichment have implications for restoration feasibility and long-term habitat resilience.

- Scrub encroachment – Willow and birch scrub is present across the transition mire at Lough Garr in varying densities. While it is not currently a significant issue, if site conditions were to deteriorate, for example, through a drop in the water table or increased drying, scrub could expand, leading to changes in species composition and a decline in characteristic mire vegetation.
- Hydrological modification - Although the site remains sufficiently wet to support its existing habitats, drainage continues to exert pressure at Lough Garr. Features include an infilled boundary drain and internal channels, some partially infilled and others still functional. These modifications have altered the hydrological regime, reducing water retention and disrupting the natural water table dynamics critical for fen habitat maintenance.

The boundary drainage infrastructure appears to be non-functional, with the 456m channel infilled by vegetation such as *Phragmites australis*. However, there is the potential that non-functional drains can continue to influence site hydrology by fragmenting flow paths or acting as conduits for nutrient movement.

- Nutrient Enrichment – Currently considered a minor, localised pressure affecting only a small area of the site, this issue poses a low risk at present. However, continued monitoring is recommended to ensure early detection of any escalation that could negatively impact species composition within the fen habitat at Lough Garr.

Table 4-3: Site Conservation Priority Matrix for Lough Garr Site

Level	Feature Type	Feature Name	Extent/ Population	Pressure/Threat affecting it	Restoration Measure On-Site	Restoration Measure Off- Site
1	Annex I quality habitat	7140 Transition mires	14.35 ha	Scrub encroachment Eutrophication Drainage	Vegetation monitoring Hydrological monitoring for eutrophication & drainage. Potential for scrub removal in the future.	Control nutrient inputs
		7110 Active raised bogs	Isolated patch	Scrub encroachment Eutrophication Drainage	Vegetation monitoring Hydrological monitoring for eutrophication & drainage. Potential for scrub removal in the future.	Control nutrient inputs
		91E0 Alluvial Forest	Undetermined	*	Vegetation monitoring	N/A
2	NHA Habitat	PB1 Raised bog	Undetermined	*Scrub encroachment	Vegetation monitoring Potential for scrub removal in the future.	N/A
3	European Priority Species	Marsh fritillary <i>Euphydryas aurinia</i>	1 record (2020)	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	No measures currently proposed for this specific feature.
4	Nationally important species	Species of caddisfly <i>Tricholeiochiton fagesii</i>	1 record (2020)	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	Control nutrient inputs
		Peacock butterfly <i>Aglais io</i>	1 record (2020)	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Orange-tip butterfly <i>Anthocharis cardamines</i>	1 record (2020)	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A

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Level	Feature Type	Feature Name	Extent/ Population	Pressure/Threat affecting it	Restoration Measure On-Site	Restoration Measure Off- Site
		Speckled wood butterfly <i>Parage aegeria</i>	1 record (2020)	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Emperor moth <i>Saturnia pavonia</i>	1 record (2020)	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Rigid bog-moss <i>Sphagnum teres</i>	1 record (2020)	Scrub encroachment Eutrophication Drainage	Vegetation monitoring	Control nutrient inputs
		Lapwing <i>Vanellus vanellus</i>	Recorded in ZOI	Scrub encroachment Drainage Eutrophication	Vegetation monitoring Hydrological monitoring for eutrophication & drainage. Potential for scrub removal in the future.	Control nutrient inputs
		Meadow pipit <i>Anthus pratensis</i>	Recorded in ZOI	Scrub encroachment Eutrophication Drainage	Vegetation monitoring	Control nutrient inputs
		Skylark <i>Alauda arvensis</i>	Recorded in ZOI	Scrub encroachment Eutrophication Drainage	Vegetation monitoring	Control nutrient inputs
		Sparrowhawk <i>Accipiter nisus</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Yellow shell moth <i>Camptogramma bilineata</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A

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Level	Feature Type	Feature Name	Extent/ Population	Pressure/Threat affecting it	Restoration Measure On-Site	Restoration Measure Off- Site
		Daubenton's bat <i>Myotis daubentonii</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Leisler's bat <i>Nyctalus leisleri</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Soprano pipistrelle <i>Pipistrellus pygmaeus</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Badger <i>Meles meles</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Hedgehog <i>Erinaceus europaeus</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Irish hare <i>Lepidus timidus hibernicus</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
		Otter <i>Lutra lutra</i>	Recorded in ZOI	Eutrophication	Hydrological monitoring	Control nutrient inputs
		Pine marten <i>Martes martes</i>	Recorded in ZOI	No current pressures/threats affecting the species	No measures currently proposed for this specific feature.	N/A
5	Habitats and species of local interest	PF3 Transition mires	Widespread	Scrub encroachment Eutrophication Drainage	Vegetation monitoring Hydrological monitoring for eutrophication & drainage. Potential for scrub removal in the future.	Control nutrient inputs

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Level	Feature Type	Feature Name	Extent/ Population	Pressure/Threat affecting it	Restoration Measure On-Site	Restoration Measure Off- Site
		WN6 Wet willow-alder- ash woodland	Patches within site	Drainage	Vegetation monitoring	N/A

4.3 Impact Assessment Notes

Restoration actions proposed for Lough Garr aim to improve the ecological condition of the Annex quality habitats on site. These actions are designed to support favourable conservation status and enhance habitat resilience. However, potential impacts, both direct and indirect, must be carefully assessed to ensure compliance with Article 6(3) of the Habitats Directive.

The restoration measures proposed for Lough Garr are directly connected to the management of the NHA and inherently connected with maintaining the favourable conservation status of the site itself.

Potential Impacts

- **Habitat loss** – no risk - vegetation monitoring is proposed which will not result in the loss of any habitat.
- **Habitat degradation** – very low risk – vegetation monitoring will require personnel to access the monitoring points of the site. This will result in some temporary local impacts to habitat following the surveys, however the monitoring surveys will not require multiple visits in short space of time and therefore any minor damage that may occur from human disturbance will naturally recover.
- **Species disturbance** – very low risk – Lough Garr is located approximately 2.5km from Lough Iron SPA and approximately 1km from Garriskil Bog SPA (Garriskil Bog SAC designated for habitats only). Lough Iron SPA is designated for whooper swan *Cygnus cygnus*, teal *Anas crecca*, coot *Fulica atra*, golden plover *Pluvialis apricaria*, Greenland white-fronted goose *Anser ablifrons flavirostris*, wigeon *Mareca penelope* and shoveler *Spatula clypeata*. Garriskil Bog SPA is designated for Greenland white-fronted goose *Anser ablifrons flavirostris*. Monitoring surveys are recommended during the main growing season when vegetation can be reliably identified (late May to early September). Therefore, should Lough Garr be functionally linked to these other sites, birds would be utilising the site in the winter period and therefore unlikely to be disturbed during monitoring surveys.
- **Introduction and/or spread of invasive non-native species** – moderate risk – The potential for surveys to facilitate dispersal of invasive species whilst visiting the site for monitoring surveys. Surveyors should adopt biosecurity measures such as check-clean-dry on footwear and apparel prior to attending the site.

4.4 *Good Practice Recommendations*

Several good practice measures are recommended based on the requirement for compliance with legislation but also the occurrence of sensitive receptors and possible pathways for negative effects during preparation for or implementation of restoration actions. These are summarised in Table 4-4 below and should be taken as generally applicable in the planning of FRP.

Consultation with relevant NPWS staff should be undertaken prior to implementation to obtain more recent or up to date information on the locations of sensitive receptors, and buffers revised accordingly. Any further requirements outlined by NPWS at pre implementation stage should also be adhered to.

Table 4-4: Good Practice Recommendations

Receptor	Measure
Ground nesting birds	No vegetation clearance or activity which might contravene Section 40 of the Wildlife Act 1976 (consolidated) should be undertaken.
Invasive Alien Species	All vehicles should undergo stream cleaning before site entry. Where an IAS is discovered during site works, identified buffers on IAS should be avoided during site preparation and restoration implementation.
Protection of European Sites	Any required mitigation measures to avoid potentially adverse effects on European Sites should be incorporated into an Environmental Management Plan or Checklist of Environmental Commitments. Implementation should be overseen by a suitably qualified ecologist.
Protection of Sensitive Habitats	High sensitivity habitats should be protected from long term damage by the use of low-pressure vehicles. Extensive repeated tracking over fen habitat or any other identified priority habitat should be avoided. The storage locations of any materials should avoid high & medium sensitivity habitats.

5 Key Pressures – Field Validation and Evaluation

The FRP considers pressures on Lough Garr through an initial desktop assessment of existing information on the site (including previous NPWS commissioned surveys), assessment of land, water and topographic data and aerial imagery, followed by field surveys to characterise and confirm key pressures mapped through desktop assessment. Consultation with NPWS Regional Staff was also undertaken, including a visit with the Conservation Ranger for the area to inform identification of pressures.

The PFS (O'Neill, et al., 2023) undertook a site evaluation and ranking which determined the conservation value of the site. This evaluation considered 15 criteria as outlined which included naturalness, non-recreatability, potential value, typicality, educational value, size, diversity, fen value, rarity of species, rarity of habitats, viability, recorded history, management needs, intrinsic appeal and expert opinion. These criteria were subsequently used to guide the overall assessment of conservation status.

The conservation status assessment results for Lough Garr is summarised in Table 5-1.

Table 5-1: Conservation Status Assessment (O'Neill, et al., 2023)

Annex I quality habitat	OVERALL CONSERVATION STATUS ASSESSMENT				
	Area	Structure & functions	Future prospects	Rationale	Overall Conservation Status
7140	14.35	Favourable	Unfavourable.- Inadequate	Issues with scrub encroachment, drainage impacts and nutrient enrichment risks.	Unfavourable.- Inadequate

5.1 Field surveys of key pressures

Following completion of desktop mapping of key pressure, field surveys were carried out by personnel to verify the findings of the desktop assessment and characterise conditions of the pressures to inform selection of appropriate restoration actions required. The site surveys are discussed in Sections 3.2 and 4.2. These surveys aimed to capture information on the land and water environment such as drainage features, peat depth and water quality and ecology.

As part of the ecology monitoring surveys, pressures and threats associated with the monitoring point were recorded. A summary is provided within Section 5.2.

5.2 Key Pressures

An overview of the key pressures identified on site, following desktop review and in-situ walkovers is summarised below.

5.2.1 Hydrology Pressures

The reduction in open-water extent suggests that historically, drainage appears to have been a key pressure on fen hydrology in the northeast of the site.

This drain is part of the Arterial Drainage Scheme (ADS). The ADS comprises watercourses and related works managed under the Arterial Drainage Act, 1945 to improve land drainage and mitigate flooding. Schemes involved modifying rivers, lakes, weirs, bridges, and constructing embankments to enhance conveyance, lower water levels during the growing season, and protect adjacent lands from flooding. Covering mainly flat areas, these schemes are maintained by the OPW and were implemented from 1947 to the 1990s (OPW, 2025).

Based on the observed water levels and absence of flow during the site visits, it is likely that this drain is currently helping to maintain water levels within the fen, likely due to long-term vegetation growth and sediment deposition creating partial blockages. Any modification of this drain, or clearance of vegetation within it, could therefore introduce a significant hydrological pressure by draining the fen.

5.2.2 Nutrient pressures

Nutrient enrichment is an historical pressure, which was not evidenced during site walkover in 2025. In addition, recent water-quality data collected during the site visits show no noticeable deterioration in drain water quality, with results remaining below the recommended environmental thresholds. Continued monitoring is advised to ensure these activities do not become a hydrological or water-quality pressure in the future.

It is important to note that whilst this pressure was not observed during site walkover, it does not necessarily mean it is not present and as such should be considered as potentially current.

The nutrient enrichment is likely originating from adjacent agricultural activities, which can cause diffuse pollution to surface and/or groundwater.

5.2.3 Flora and Fauna Pressures

The following pressures are listed in order of their intensity and impact on the ecological receptors of Lough Garr. These were determined from the review of historical information (PFS) and gathered from observations made along the monitoring points carried out as part of this project.

- **Scrub encroachment** – While birch and willow regeneration is evident at various points across the site, this pressure currently poses only a minor threat to the Annex quality 7140 transition mire habitat. The habitat is in good condition at present; however, any decline in its health could allow scrub encroachment to become a significant issue for its future prospects and overall status.
- **Drainage** – The site contains a drain along the northeast boundary and remnants of historical drainage features. These can alter water tables and disrupt hydrological

flow, influencing fen vegetation patterns and promoting scrub encroachment. Although the main drain is now infilled with vegetation, its impact on site hydrology is still active. At present, this pressure is considered minor due to the habitat's good condition; however, any deterioration could amplify its effect and pose a potential threat to the Annex quality 7140 transition mire habitat.

- **Nutrient enrichment** - Evidence of this was observed in a localised area of the site as minor algal growth. Such enrichment can alter species composition and reduce the prevalence of characteristic mire vegetation. Currently, this pressure is considered minor because the habitat remains in good condition; however, any decline in habitat health could increase its impact on Annex I quality transition mire habitat.

6 Restoration Measures

6.1 *Introduction*

The restoration actions proposed by the FRP will help to maintain or improve the quality of existing areas of fens and improve the conditions that will allow an expansion of the area of transition mire. In some areas it must be recognised that restoration to transition mire will not be possible, and the objective may simply be to improve the habitat condition.

Selection of the most appropriate restoration action depends on a range of factors including peat depth, hydrological conditions (flow rates, existing and expected flow paths after restoration), substrate type, existing ecological conditions, potential ecological constraints and practicality of access for machinery.

Each of the factors was considered based on a combination of desktop analysis combined with site-specific field surveys to select the most appropriate restoration technique to address each pressure considered by the FRP. A non-technical summary is presented in Appendix A.

6.2 *Hydrology Measures*

The primary aim of the hydrology restoration measures is to monitor that water levels remain close to the surface and increase the duration and frequency of saturation across the wetland, without causing inundation. The restoration measures will be undertaken as part of the Tóchar Fen Restoration Project and the follow-on long-term monitoring will be the responsibility of the NPWS.

6.2.1 *On-site Hydrology Measures*

6.2.1.1 *Surface and Groundwater monitoring*

Groundwater and surface water levels will be monitored in a network of piezometers and standpipes at key locations within the site and surroundings. This initial step will establish a number of monitoring points to create a water level baseline.

Level loggers will record water level changes, and data will be reviewed to identify trends. Rainfall and evaporation will be measured using nearby stations, and habitat condition assessments will support restoration monitoring.

Based on site visits, the main drain does not appear to actively drain the fen, rather, it retains surface runoff and helps maintain water levels. Site inspections every year, particularly during drier months, are recommended to ensure water levels remain supportive of fen habitat.

(Placeholder additional measures might be needed depending on lidar survey analysis)

Water levels within the main drain (C32/1) will need to be monitored to make sure it is not draining the fen. Communication with OPW is needed to ensure the ongoing maintenance programme of the wider Inny Arterial Drainage Scheme removes does not include C32/1.

The proposed monitoring locations are shown in Appendix C.

6.2.2 Off-site Hydrology Measures

6.2.2.1 Avoid creating new pits or ditches

There is a need to engage surrounding landowners, to ensure that no drainage takes place on adjacent lands that could interfere with the site's water balance.

A clear hydrological baseline should be established, with annual checks to verify that drainage intensity or extent has not increased.

6.3 Nutrient Measures

The primary aim of the nutrient measures is to maintain appropriate water quality, particularly nutrient levels, to support the natural structure and functioning of the habitats.

6.3.1 On-site Fen Nutrient Measures

6.3.1.1 Water quality monitoring

On-site nutrient measures include the monitoring of water quality within the site to assess the effectiveness of proposed off-site nutrient measures and identify any changes in water quality within the site which may require a modification of measures.

Water quality monitoring is to include nutrients (Nitrates and Phosphates), electrical conductivity and pH.

The proposed monitoring locations are the same as those surveyed in October and November 2025 and are shown in Appendix C.

6.3.2 Off-site Nutrient Measures

6.3.2.1 Catchment nutrient management

Based on the results of the site visit inspections, there does not appear to be an existing nutrient issue across the site. However, monitoring over time may reveal emerging seasonal trends, and targeted nutrient control measures across the catchment could then be implemented if required.

If future monitoring indicates increased nutrient pressures, measures should address both phosphate and nitrogen pathways. PIP maps and field water-quality data suggest that phosphorus runoff could be a concern around the drain in the northeast of the site, meaning any future measures would need to consider the Inny (Shannon) sub-catchment and overland flow pathways along the northeastern boundary.

Nitrate could also become an issue in the northeastern area, with potential pathways into the fen via groundwater and surface-water runoff from the Coillte forest and adjacent agricultural fields. Should nitrate levels increase in the future, measures should focus on the groundwater and surface-water catchment supplying flow to the northeast of the site.

Measures outlined under the Farming for Water EIP are categorised by source, pathway and receptor. Suitable measures for Lough Garr may include:

- **Source control measures:**
M2 Farmer Training Course for farmers in the fen catchment.
M3 Nutrient Management Plan to support optimal slurry application and nutrient uptake, avoiding overapplication.
- **Pathway interception measures:**
M15 Linear Riparian Buffer Zones (grassland), potentially appropriate along the northeastern drain to prevent phosphate runoff.
- **Receptor measures:**
M30, M31, M32 Bovine/Ovine exclusion from waterbodies. While direct livestock access was not observed during site visits, this may be suitable further upstream on the Inny_080 river if areas of encroachment are identified.

Coordinate with Coillte regarding forestry operations, highlighting that runoff from the forest can affect nutrient inputs and water levels in the fen, and ensure management practices are aligned to protect the site's nutrient balance.

6.4 *Vegetation Measures*

6.4.1 *On-site Vegetation Measures*

Proposed measures to address vegetation succession and scrub encroachment include the following on-site measure described in Table 6-1:

- Commence regular monitoring of the vegetation composition at the defined monitoring points within Lough Garr. Monitoring should take cognisance of pressures and threats to the relevant habitats, the vegetation composition of the habitat and positive and negative indicators. The results of regular monitoring will advise on the necessity for scrub removal.
- Scrub removal may be necessary where the results of vegetation monitoring indicate that scrub is beginning to exert a pressure upon the habitat type. Removal may occur through mechanical or hand-tool means but will be informed by the results of the monitoring.
- Coordination with Coillte, as Lough Garr is identified within their Biodiversity Action Units, to further improve the site for biodiversity.

Table 6-1 On Site Vegetation Measures

Measure	Description	Responsibility
Vegetation Monitoring	The proposed vegetation monitoring for the fen habitats at Lough Garr will focus on assessing the current condition of the habitat, which is presently considered to be in good status with low levels of pressure. The approach will involve systematic recording of vegetation composition and structure through the use of relevés, alongside identification of any emerging pressures or threats such as invasive species, hydrological changes, or nutrient enrichment. This monitoring will provide a baseline for ongoing evaluation and will help detect subtle changes over time. By documenting species diversity, cover, and habitat characteristics, the process will inform whether any restoration measures are required to maintain or enhance the ecological integrity of the fen.	Tóchar & NPWS (post-Tóchar)
Scrub removal	Scrub removal may be necessary following on-going monitoring of the ecological condition of habitats on site. It may be necessary to carry out the removal of some unfavourable species such as the birch and/or over-abundant willow via mechanical, or hand-tool means. Ecological monitoring results will inform the most appropriate method for removal.	Tóchar & NPWS (post-Tóchar)
Coordination with Coillte	Coordinate with Coillte regarding the management of Lough Garr which is identified as a Biodiversity Action Unit (BAU) by Coillte (see Figure X). Ensure that actions are aligned to maintain and improve the biodiversity value of the site.	Tóchar & Coillte

Monitoring Progress

Monitoring points have been proposed which overlap with the existing PFS points. The purpose of these points is to monitor species composition within the habitat. This serves to monitor the rate, if any, of succession and/or general scrub encroachment which in turn informs the need for further works outside the Tóchar fen restoration programme, such as scrub removal.

7 Additional Considerations

7.1 *Drainage Management Plan*

Drainage Districts were designated by the Commissioners of Public Works 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 Arterial Drainage Act, 1945 contains a number of provisions for the management of Drainage Districts in Part III and Part VIII of the act.

There is a channel (C32/1) to the east of Lough Garr site boundary, part of the Arterial Drainage Scheme (ADS) managed by OPW. In recent meeting with OPW, Environment Section, it was confirmed that the drain along the eastern boundary of Lough Garr had been recently maintained and consequently will not be maintained again in the near future. Consultation is required with OPW on the maintenance and function of the C32/1 channel and the impact of proposed restoration measures including potential drainage plans on the fen and on the objectives of the ADS.

The preliminary drainage management plan for Lough Garr is presented in Appendix C.

7.2 *Archaeology*

There are four historical monuments near the site with their locations shown in Figure 7-1. To the north-east, approximately 312 m from the site boundary, is a former moated site (WM00257), now largely levelled and visible only as a band of darker vegetation. About 440 m to the east lies an enclosure (WM00263), historically annotated as a 'fort' but now consisting mainly of a small field with no surviving antiquity. Approximately 600 m to the south, outside the site boundary, is a ringfort (WM00264), sub-circular in plan with a poorly preserved earthen bank and shallow fosse, surrounded by forestry plantation. A fourth monument is recorded further away from the site to the south-east. Located in Cappagh townland (WM03632), it comprises an isolated inhumation burial uncovered in 1988 during the removal of a field fence. The grave was unlined and covered with limestone pebbles, with no associated artefacts.

There are no proposed intrusive on-site or off-site works in the vicinity of the archaeological sites.

A4

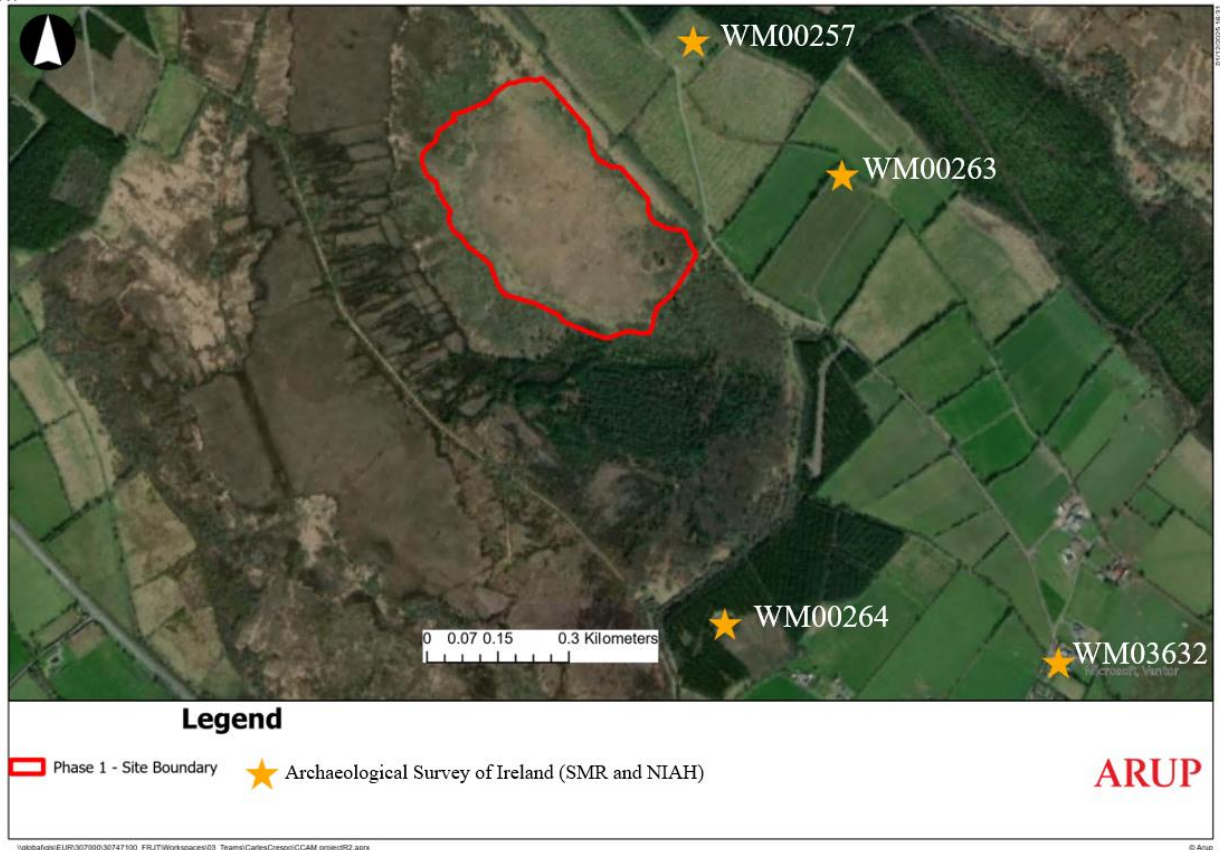


Figure 7-1: Archaeological Survey of Ireland – historical monuments near the site boundary

8 Summary of Fen Restoration Plan Actions

Prior to proceeding with the implementation of the restoration measures outlined in the FRP, consultation with landowners and key stakeholders with an interest in the site is essential (Table 8-1). While this FRP identifies the key pressures and actions to be implemented, consultation with landowners and stakeholders may identify the need to amend or alter restoration actions. There may also be opportunities to provide additional benefits to the wider community. Consultation with local NPWS staff will be crucial to informing implementation planning.

Table 8-1: Role players in fen restoration plan

Measures	Stakeholder	Description
On-site	Coillte	Landowner of Lough Garr
	OPW	The drainage to the east of the site is part of OPW Arterial Drainage Scheme
	National Monument Services / County Council	Archaeology
Off-site	Coillte	Landowner of adjacent land to the south of the site
	Westmeath County Council	To be informed about proposed restoration measures
	Landowners & farmers	Parcels to the west boundary of Lough Garr are under Commonage ownership by private individuals. Engagement for uptake of catchment measures
Capacity building	NPWS	NPWS engaging in community education and events
	LAWPRO	LAWPRO team engages with farmers through Farming for Water EIP

This section provides the summary of the implementation plan for Lough Garr as well as the habitats benefiting from it (Table 8-2).

Table 8-2: Implementation plan for Lough Garr Fen Restoration

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
1	Required preliminary actions							
1.1	Screening for Appropriate Assessment report.							
	Screening for AA to be completed.	Sitewide	Screening report	Pre-restoration	NPWS			NPWS
1.2	Drainage management plan							
	Consultation with OPW on the Arterial Drainage Scheme is required to ensure compliance with management plan objectives.	Sitewide	Drainage management plan	Pre-restoration	NPWS	OPW	Arup	Within Tóchar project scope
2	Enabling Works							
2.1	Pre-Restoration Works Surveys							
	Pre-site walkover with Ecologist/Ecological Clerk of Works (ECoW) to ensure proposed measures are appropriate and whether alterations are required.	Sitewide	ECoW report	Pre-restoration			Arup	Within Tóchar project scope
2.2	Implementation of Mitigation Measures							
	Ecological Impact Assessment Considerations – Placeholder. To be defined after LiDAR survey has been completed.	Sitewide	ECoW report	Pre-restoration			Arup	Within Tóchar project scope
2.3	Good Practice Recommendations and CEMP							

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Lough Garr Fen Restoration Plan

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	Avoid creating new pits or ditches Engage with landowners around the site, particularly those with lands hydrologically connected to Lough Garr via drains or surface flow, to ensure no drainage occurs that could affect the fen's water balance.	Surrounding farms	Landowner awareness	Long-term	NPWS		Surrounding landowners	Farming for Water EIP / other similar
4.2	Nutrient measures							
	Catchment nutrient management Targeted nutrient control measures should be implemented across the catchment to address both phosphate and nitrogen pathways. Measures may include source control measures (Farmer Training Course for farmers in the fen catchment; Nutrient Management Plan; Nitrogen Surplus); pathway interception measures (Linear Riparian Buffer Zones: Grassland) and receptor measures (Bovine, Ovine exclusion from waterbodies; Vegetated bunded drain).	Surrounding landowners	Uptake of measures by landowners / farmers	Long-term	NPWS, LAWPRO, Farming for Water EIP		Landowners	Catchment measures to be funded through Farming for Water EIP / other similar
5	Monitoring progress							
5.1	Hydrology monitoring							
	Groundwater and surface water level monitoring in a network of piezometers and standpipes at key locations within the site to monitor changes to water. Level loggers will be used to monitor changes in water levels.	Various locations across site	Water level	Long-term	NPWS/ Coillte to facilitate site access			NPWS

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Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
				National	Regional/ Local	Other	
Rainfall and evaporation monitoring using site-specific or nearby stations.	Sitewide	Rainfall and evaporation levels	Long-term	NPWS/ Coillte to facilitate site access			NPWS
5.2 Nutrient monitoring							
Ongoing monitoring of habitats, drainage channels and piezometers for water quality parameters is proposed within the fen and vicinity.	Various locations within the site	Nutrients (Nitrate and phosphate), electrical conductivity and pH	Long-term	NPWS/ Coillte to facilitate site access			NPWS
5.3 Vegetation monitoring							
Habitat condition assessments will be included to track restoration progress.	Sitewide	Habitat condition	Long-term	NPWS/ Coillte to facilitate site access			NPWS
6 Capacity building and training							
Public meeting: To engage stakeholders on developments and results from the restoration measures.			Long-term	NPWS			NPWS
Farmer training: Training such as that provided by the Farming for Water EIP will provide farmers with knowledge of alternative and habitat sensitive measures			Long-term	NPWS/ Farming for Water EIP / LAWPRO / Teagasc			Farming for Water EIP / other similar

8.1 *Habitats benefiting from implementation of restoration actions*

- **7140 Annex Quality Transition mires and quaking bogs/ PF3 Transition Mire and quaking bog**

Vegetation monitoring will help detect early signs of scrub encroachment or species shifts that could compromise the open, wet conditions essential for transition mires. Combined with hydrological monitoring, this approach ensures water levels remain stable, supporting the delicate balance of mosses and sedges. Timely intervention, such as scrub removal, will maintain habitat structure and prevent succession to drier communities.

- **7110 Annex Quality Active raised bogs / PB1 Raised Bogs**

Monitoring will safeguard the hydrological regime critical for peat formation and active bog growth. Vegetation surveys will identify pressures like scrub or invasive species, while water level data will highlight any changes affecting bog surface wetness. These insights allow targeted restoration actions to preserve the active peat-forming processes and maintain Annex I habitat quality.

- **91E0 Annex Quality Alluvial Woodland / WN6 Wet willow-alder-ash woodland**

Vegetation monitoring will track species composition and structural integrity, ensuring the woodland retains its characteristic wet conditions. Hydrological data will inform whether water levels support the persistence of willow and alder communities. If pressures such as drying or scrub dominance are detected, management actions can be implemented to maintain habitat diversity and ecological function.

9 References

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Appendix A - Non-Technical Summary

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan Non-Technical Summary			
Site Name	Lough Garr	NFS site no.	1004
County	Westmeath	Designations	NHA 001812
Fen habitats present (area)	7140 Transition mire (14.35ha); 7110 Active raised bogs (1.19ha); 91E0 Alluvial forest (1.62ha)	Species of note	- <i>Tricholeiochiton fagesii</i> (rare caddisfly) - Marsh Fritillary butterfly - Emperor Moth - Peacock butterfly - Orange-tip butterfly - Speckled Wood butterfly - Various dragonfly and damselfly species - <i>Sphagnum teres</i> (Near Threatened moss)
Site Description			
Lough Garr (Westmeath) is located approximately 16 km north-west of Mullingar in Co. Westmeath and includes the Lough Garr Natural Heritage Area (NHA; site code 001812), designated for the presence of Annex I quality 7140 Transition mires and quaking bogs. These habitats form the dominant habitat type within the site and are primarily distributed across the central and eastern portions of the NHA, where they grade naturally into areas of marsh, swamp, wet woodland, and both humid and dry grassland. An area of raised bog is present along the western edge of the site, comprising two areas of high bog separated by a bog road and supporting vegetation typical of Midland Raised Bog. The site also contains a small open water body that has been present since at least the early 19th century. Figure 1 presents the habitats mapped within the site.			
Conceptual Site Model (CSM)			
As a former lake basin, the landscape of Lough Garr is relatively flat, with slightly higher ground along the site boundaries and a shallow central depression. Lough Garr is fed by both surface water and groundwater sources and is situated within the Inny (Shannon) WFD sub-catchment. The WFD river waterbody Inny_080 passes along the eastern site boundary and appears to have historically drained the site towards the south-east. This is classed as drain C32/1, which runs along the eastern boundary as part of the OPW Arterial Drainage Scheme. This drain collects runoff from adjacent forestry and agricultural land and contributes water and nutrients to the fen. Flow within the drain is locally impeded by a slight upward slope and dense vegetation, resulting in water retention, ponding, and reduced drainage from the fen. Groundwater discharge from the underlying aquifer, together with surface water inflows and drainage modification, maintains wet conditions within the transition mire, which becomes seasonally inundated during winter. Lough Garr is therefore a topogenous fen, with predominantly lateral water movement. The CSM is presented in Figure 2.			

**NPWS Tóchar Midlands Wetland Restoration Scheme
Fen Restoration Plan Non-Technical Summary**

Key Pressures

Hydrology Pressures	Historically, drainage has been a key hydrological pressure on the site, contributing to a reduction in open-water extent, particularly in the north-east. However, current observations indicate that vegetation growth and sediment deposition within the drain now restrict flow, helping to retain water and maintain fen hydrology. Any future modification or clearance of the drain could therefore represent a significant hydrological pressure by increasing drainage and lowering water levels within the fen.
Nutrient Pressures	The Pilot Fen Survey indicated minor algae cover, suggesting some nutrient enrichment. Recent water-quality monitoring of the drain shows that water remains below environmental thresholds. Nutrient input is likely from adjacent agricultural activities causing diffuse pollution to surface water and groundwater. While not currently evident, this pressure should be considered potentially present, and continued monitoring is recommended.
Ecology Pressures	Drainage modification, scrub encroachment, succession and vegetation change, the absence of appropriate grazing management, are resulting in shifting fen vegetation patterns and promoting growth of non-fen species (e.g. grasses). Excess nutrients from agricultural runoff and overgrazing can also change species and lead to a loss of fen species.

Objective of Restoration Plan

The objective of the Lough Garr Fen Restoration Plan is to maintain or improve the quality of existing areas of fens and improve the conditions that will allow an expansion of the area of fen. In some areas it must be recognised that restoration to fen habitat will not be possible or preferable, and the objective is to improve the habitat condition.

While full-scale hydrological restoration aimed at re-establishing the site's former lake would offer potential ecological gains for aquatic species and waterfowl, this would result in the loss of existing fen areas.

Restoration Measures

Hydrology Measures	On-Site Measures: Monitor at the monitoring locations shown in the Site Restoration Plan map - Monitor groundwater and surface water levels using piezometers, standpipes, and level loggers, with rainfall and evaporation recorded using nearby stations.
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NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan Non-Technical Summary	
	- Ensure water levels in the main drain (C32/1) are maintained, which retains runoff and supports fen hydrology. (Placeholder additional measures might be needed depending on lidar survey analysis) Off-Site Measures: - Engage with landowners of lands hydrologically connected to Lough Garr to ensure no new pits or drainage interfere with the site's water balance. - Establish a clear hydrological baseline and monitor to verify that no new drains are created. - Coordinate with the OPW regarding drain C32/1 (Inny Scheme, East Region) to ensure maintenance does not lower water levels, dredge, or otherwise alter the fen's hydrology, and agree a plan aligned with ecological objectives.
Nutrient Measures	On-Site Measures: - Monitor water quality within the site for nitrates, phosphates, electrical conductivity, and pH (at monitoring locations) Off-Site Measures: Catchment nutrient management if monitoring shows rising levels. Measures include farmer training, nutrient management plans, riparian buffers to intercept runoff, livestock exclusion, and coordination with Coillte forestry to limit nutrient input.
Ecology Measures	On-Site Measures: Cutting and thinning areas of <i>Molinia</i>, removing scrub (gorse, birch etc.) using hand tools and potentially implement conservation grazing following monitoring by cattle breeds suitable for wetland habitat e.g. Kerry Blue, Irish Moiled or Belted Galloway.
Monitoring Progress	
Hydrology Monitoring	Groundwater, surface water and lake level monitoring within the fen as well as rainfall and evaporation monitoring.
Nutrient Monitoring	Ongoing monitoring of habitats, drainage channels and springs for water quality parameters within the fen
Ecology Monitoring	Habitat condition assessments to track restoration progress.
More information	
Fen Restoration Plan Report - Tóchar website: https://www.tocharwetlands.ie/fen-restoration/	

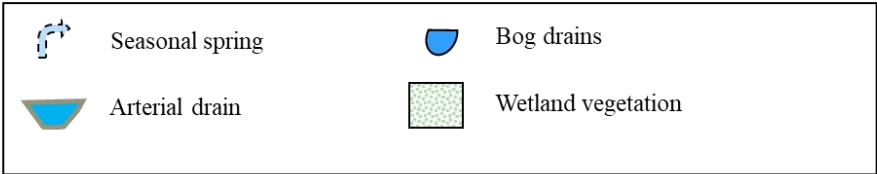


Figure 1: Site Habitat Map

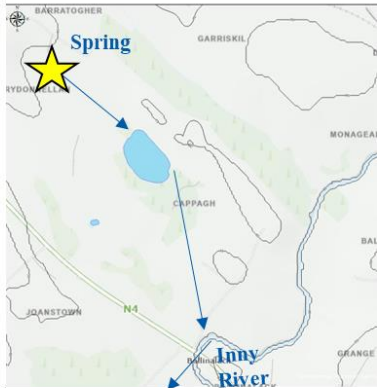
Lough Garr
Westmeath County
26F Upper Shannon

WETMEC: 3: Buoyant Weakly Minerotrophic Surfaces ('Transition Bogs')

Water key:



Vegetation:



Conceptual site model:

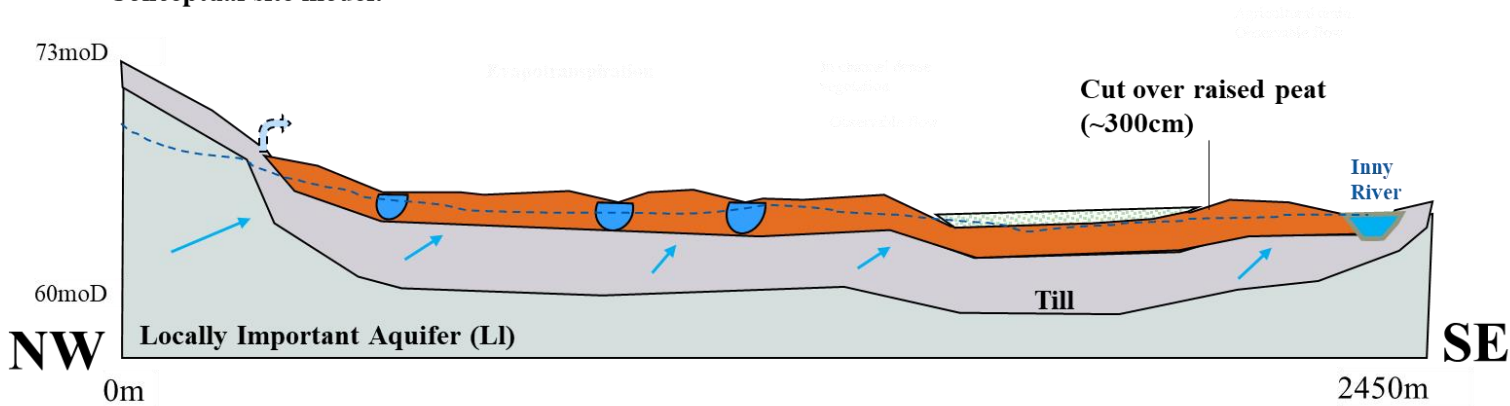


Figure 2: Conceptual Site Model

Appendix B – Ecological Survey Maps



B-1: Fossitt habitat types at Lough Garr



Figure B-2: NBDC records of the protected rigid bog-moss *Sphagnum teres* within the boundary of the Lough Garr area in this FRP

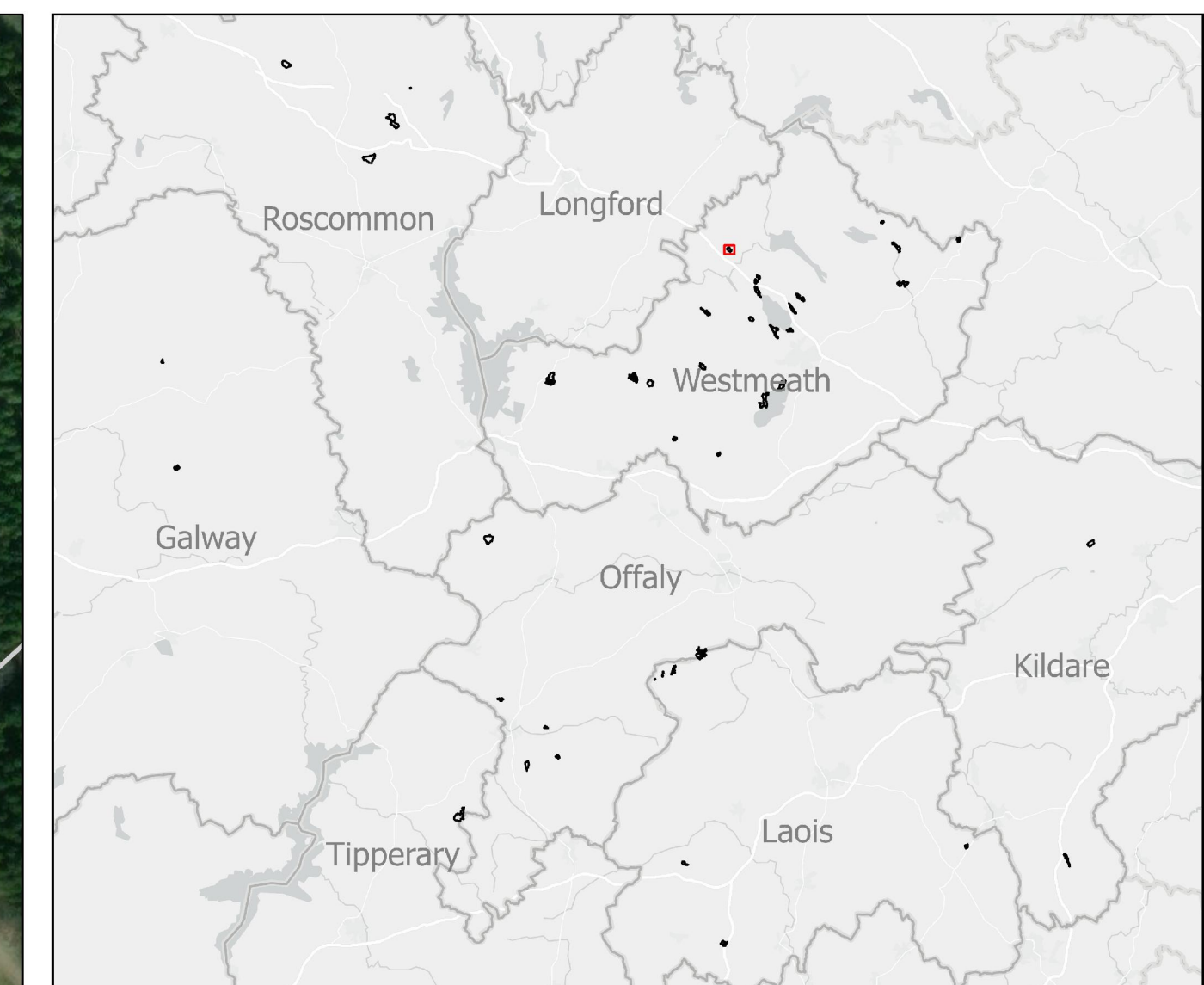
Appendix C – Restoration and Monitoring Plan

Table C1: Long-term monitoring points for fen restoration at Lough Garr

Point	Measure	Objective	Timeframe	Frequency of monitoring	Monitoring indicator
Gw_1	Hydrological	Monitoring groundwater levels and quality	Long-term	Seasonal ⁶ for year 1 Annual for year 2-5	Groundwater level on bog
Gw_2					Groundwater level on bog
Gw_3					Groundwater level on bog
Sw_1		Monitoring of surface water levels and quality	Long-term	Seasonal for year 1 Annual for year 2-5	Water level and quality at drain
Sw_2					Water level and quality at drain

⁶ Seasonal: once in winter and once in summer to represent a hydrological year

Fen Restoration - Lough Garr - Phase 1



- Legend**
- Site Boundary
 - Drains
 - Water River Network (OSI)
 - Land Parcels
- Monitoring**
- Ecology monitoring
 - Groundwater monitoring
 - Surfacewater monitoring

0 50 100 Meters

Scale: 1:2,000 | Page Size: A3
Date: 22/04/2026

Map Credits: Microsoft, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Appendix C – Drainage Management Plan

NPWS Tóchar Midlands Wetland Restoration Scheme

Fen Restoration Plan: Drainage Management Plan

Site name	Lough Garr		
County	Westmeath	NFS site No.	1004
Catchment overview:			
The site sits at an elevation of approximately 67 mOD and is relatively flat, with higher ground along the boundaries and a slight depression towards the centre.			
WFD catchment	26F Upper Shannon	WFD Sub-catchment	Inny (Shannon)_SC_050 (26F8)
Drainage Area	None	Drainage District	No
Responsible authority	None	Maintenance date	TBD
Surrounding landowners	Coillte, landowners		
Wetland drainage			
The EPA River Waterbody Map indicates the WFD river waterbody Inny_080 passes through the site boundary and appears to have historically drained the site towards the south-east. At present, this river, which could be better described as a drain, shows no observable flow, based on the site inspections carried out in October 2025.			
The main surface water feature within the site is this drain (C32/1), which forms part of the OPW Arterial Drainage Scheme and runs from along the eastern boundary of the site. This drain collects surface water runoff from the forestry to the north-east and from surrounding agricultural fields, contributing nutrients to the fen. Water is retained within the drain, helping to maintain water levels within the fen. Water accumulates south of the drain due to an upward slope toward the southeast, forming a localised dip within the drain that retains water. Dense vegetation further restricts flow. This accumulation of water causes ponding in that area and limits water drainage from the fen. Beyond this vegetated area, where the main drain (C32/1) connects with the north-east agricultural drain outside the site boundary, water flow increases, and an observable flow develops towards the southeast along the drain.			
The site’s hydrological characteristics results from the combination of groundwater discharge, surface water inflow and drainage modification. These elements have influenced habitat development and the spatial distribution of springs and seepages over recent decades. Lough Garr is a topogenous fen as water movement is predominantly lateral entering through the overland flows and from the ground inflow.			

NPWS Tóchar Midlands Wetland Restoration Scheme					
Fen Restoration Plan: Drainage Management Plan					
Surface water inflow	None		Surface water outflow	None	
Groundwater inflow	Diffuse groundwater seepage				
Internal drains	None		Perimeter drains	Drain (C32/1) in the eastern part of the site	
On site hydrology measures:					
The existing drain (C32/1) does not appear to actively drain the fen, rather, it retains surface runoff and helps maintain water levels. Therefore, the following on site measure are proposed: • Monitor groundwater and surface water levels using piezometers, standpipes, and level loggers, with rainfall and evaporation recorded using nearby stations. • Ensure water levels in the main drain (C32/1) are maintained, which retains runoff and supports fen hydrology.					
Off-site hydrology measures:					
Off-site measure 1	Avoid creating new drainage channels /modifying existing		Role player	NPWS/Surrounding landowners/Coillte/OPW	
It is necessary to interact with neighbouring landowners (farmers and Coillte), especially those whose properties are hydrologically linked to Lough Garr through surface flow or drainage. Agreements should be arranged to guarantee that no drainage occurs on nearby properties that can disrupt the water balance of the site. Coordination with the OPW regarding drain C32/1 (Inny Scheme, East Region) should also take place, to ensure maintenance does not lower water levels, dredge, or otherwise alter the fen’s hydrology, and agree a plan aligned with ecological objectives In addition to engaging with stakeholders, establishing a clear hydrological baseline will allow for ongoing monitoring and ensure that no new drains are created, as changes can be identified by comparing future measurements with the baseline.					
Monitoring progress					
Refer to onsite hydrology measures section					
Indicator	Water level	Location	Various locations across site	Role players	NPWS/OPW
Refer to onsite hydrology measures section					



Legend

-  Site Boundary
-  Drains

ARUP

Figure 1: Mapped drainage network and flow direction at Lough Garr