National Parks & Wildlife Service

Tóchar Midlands Wetland Restoration Scheme

Kilnaseer

NFS site No.

109003

Fen Restoration Plan

July 2026

Tóchar
Athchóiriú Bogach Lár na Tíre
Midlands Wetland Restoration

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National Parks and Wildlife Service

Fen Restoration Plan

Kilnaseer
Part of the River Barrow and River Nore SAC (109003)

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Executive Summary

Kilnaseer (Laois) is a site located 5 km east of Rathdowney in a lowland landscape of improved pasture. The Kilnaseer site is within the boundary of the River Barrow and River Nore SAC (Site Code 002162). The designations for this SAC relevant to Kilnaseer are 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicionalbae),* which occurs in the centre of the site, and 1016 *Vertigo moulinsiana* (Desmoulin's whorl snail), which has been recorded immediately adjacent to the northern boundary of the site. The rest of the site consists of a mosaic of Annex quality 7140 Transition mire and 7230 Alkaline fens with small patches of 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* present within the 7230 Alkaline fens habitat in the northern area of the site.

This assessment of Fen Restoration Plan (referred to hereafter as FRP) has been developed to set out proposals for the restoration of 7140 Transition mires and 7230 Alkaline fens to contribute to the achievement of favourable conservation condition of fen habitat.

This is a site-level plan that will be subject to refinement prior to implementation of restoration actions in each subsite. The assessment primarily considers the following pressures that may be impacting on the hydrological function and/or favourable condition of the fen habitat:

- Drainage
- Scrub encroachment
- Changes to water quality, e.g. nutrient enrichment
- Over or under grazing
- Invasive species e.g. scattered self-seeding conifers

Other pressures (e.g., burning, turf cutting, damage by recreational vehicles) may be present within the site, and will be considered following the desktop assessment and following a reconnaissance visit of the targeted areas for restoration measures. Factors such as landownership and management will dictate the ability of addressing such pressures as part of this FRP.

This assessment was developed using a desktop assessment of previous studies of Kilnaseer commissioned by NPWS including the surveys carried out in 2022 as part of the National Fen Survey (NFS). Detailed aerial imagery and topographic datasets were then used to map all drainage features within the site. Hydrological and ecological field surveys were undertaken to collect additional information to validate the findings from desktop assessment and inform the selection of suitable restoration actions, considering the conditions found on site and possible constraints.

Drainage features, water quality and ecology were assessed, and a recommendation made for suitable restoration actions. A prioritisation exercise has been completed to identify restoration measures that should be targeted first in progressing the implementation of these restoration

requirements. Consultation with stakeholders, and further site investigations, will be the next key steps required to refine this assessment prior to proceeding to the implementation phase(s). The key measures proposed by this assessment are

On-site measures:

- Drain blocking: partial drain blocking will help raise the water levels in the fen.
- Water quality monitoring: to maintain low nutrient, calcium-rich conditions in the fen.
- Conservation grazing: light grazing where vegetation is going rank and reduced grazing where overgrazing/mowing is occurring will maintain appropriate species communities.
- Removal or cut scrub and saplings: target removal of younger willow scrub saplings to maintain the community and reduce scrub encroachment.
- Removal of invasive species: targeted clearance of rhododendron and cherry laurel to maintain the community and reduce further spread.

Off-site measures:

- Restoration of groundwater hydrology: engagement with landowners for best practice regarding land management to reduce fertiliser use and improve nutrients entering the site from surrounding lands. Regularly test pH, calcium and nutrient levels in the surface and groundwater. Engage with Coillte for best practice regarding forestry land and water management. Water quality monitoring done along with observing the catchment measures such as nutrients entering the fen from surrounding land.

Habitat and Restoration Map

The habitats recorded during the 2022 NFS and classified according to the Fossitt Habitat Classification system is presented in Figure 1-1.

The Restoration and Monitoring Map including both hydrological and ecological measures is presented in Figure 1-2.

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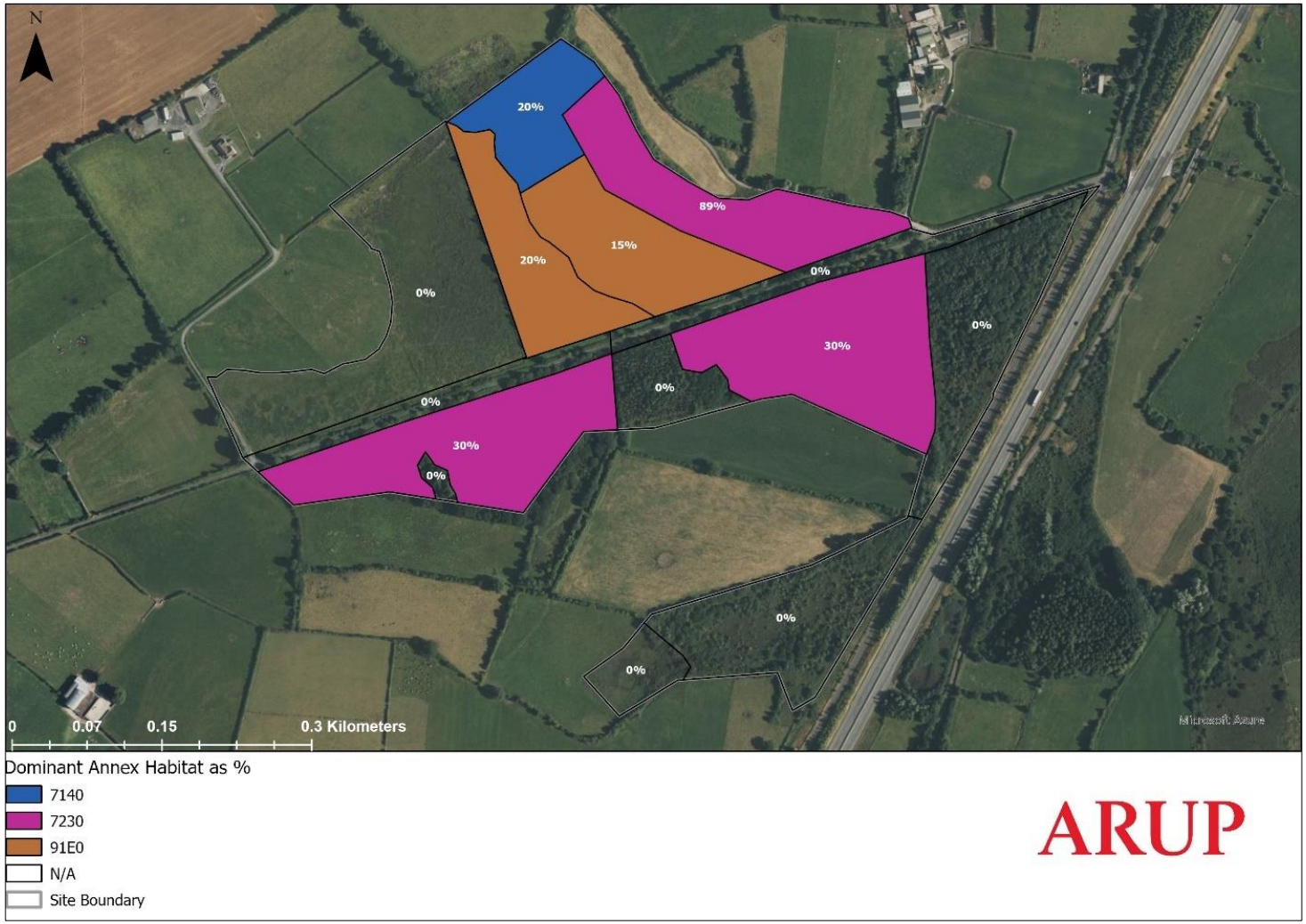


Figure 1-1 Annex I quality habitats recorded and mapped as part of the 2022 NFS. Note the % value indicates the %cover of the Annex I quality habitat recorded in the polygon. See Table 9-1 for the full directory of habitat codes and names.

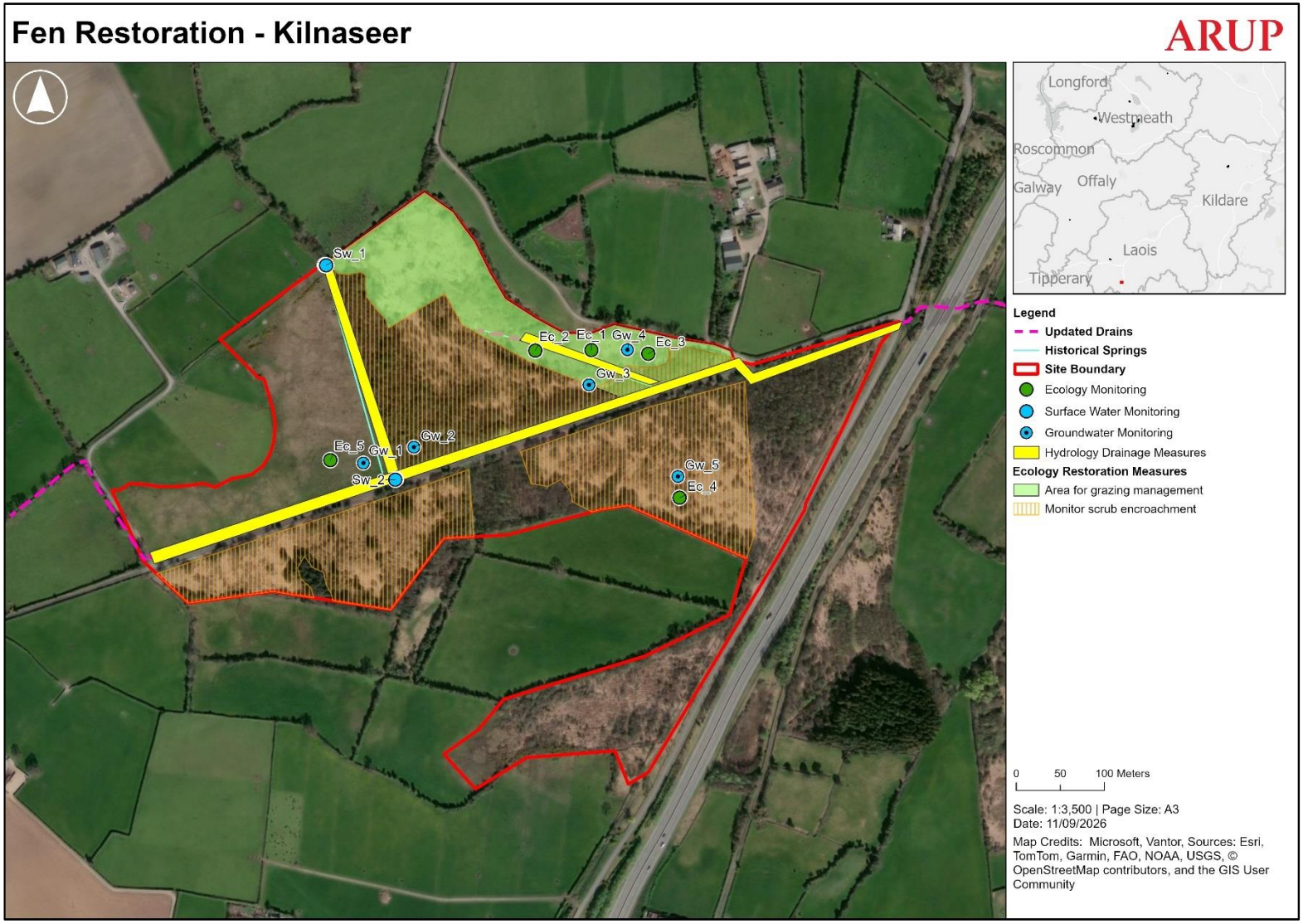


Figure 1-2: Proposed Restoration measures for Kilnaseer

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, The FENCES Project team and the Tóchar Wetlands Project Team, including Shirley Clerkin (Project Manager), Monica Byrne (Project Administrator), Hazel Daly (Community Engagement Officer), and Emily Nolan (Community Engagement Officer).

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 developed by Arup on behalf of National Parks and Wildlife Service (NPWS) to set out proposals for restoration of Annex[1] quality[2] habitats of 7140 Transition mires and quaking bog (hereafter referred to as 7140 Transition mire), 7210 Cladium fen and 7230 Alkaline fen habitats within the site which contributes to favourable conservation condition of the fen habitat on site

The Kilnaseer site is within the boundary of the River Barrow and River Nore Special Area of Conservation (SAC) (site code: 002162) and is located 5 km east of Rathdowney in a lowland landscape of improved pasture in Laois. This report considers the habitats within the Kilnaseer site only (referred to as 'the site') and not the full list of Qualifying Interest (QI) habitats of the wider River Barrow and River Nore SAC. The site covers a total area of 23.55ha and is dominated by fen habitat although several other associated wetland habitats are also present as identified during the NFS in 2022 (Brophy et al., in prep).

The designations for the River Barrow and River Nore SAC relevant to Kilnaseer are 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicionalbae)* (Hereafter referred to as 91E0 Alluvial forests), which occurs in the centre of the site and in which a small area of Annex quality 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (Hereafter referred to as 6430 Hydrophilous tall herb fringe communities) exists, and 1016 *Vertigo moulinsiana* (Desmoulin's whorl snail), which has been recorded immediately adjacent to the northern boundary of the site. According to the National Fen Survey (NFS) carried out in 2022, the total extent of the 7140 Transition mire habitat at Kilnaseer is 0.49 ha, while the 7210 Cladium fen covers 0.8ha and the 7230 Alkaline fen covers 3.56ha.

The main aim of the restoration actions proposed as part of this assessment is to maintain or improve the quality of existing areas of fen or improve the hydrological conditions that will allow an expansion of the measurable area of fen thus impacting on favourable condition of the fen. However, in some areas, it must be recognised that restoration to increase areas of existing fen will not be possible due to unsuitable hydrological conditions, and the objective may simply be to ensure no further deterioration.

[1] Each habitat and species type protected under the EU Habitats Directive (Council Directive 92/43/EEC of 21 May 1992) 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.

[2] Annex I quality habitats are habitats which meet the ecological characteristics of Annex I habitat types but occur outside designated Special Areas of Conservation

Although the focus of the restoration plan is on fen habitat, it is anticipated that restoration actions will also benefit other wetland habitats and its dependent species, including Annex I 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicionalbae*), a QI of the River Barrow and River Nore SAC, which was mapped during previous surveys of the site (NFS 2022). 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.

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 trapping pollutants and sediments, thus enhancing water quality downstream. Additionally, fens store significant 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 minimise 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 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; Wilson *et al*. 2015). 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.

The restoration of fen habitat can 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 also reducing flood risk.

1.3 Key pressures on Fens

The overarching (National) key pressures and threats to Annex I fen habitats and the Annex II species *Vertigo moulinsiana*, have been identified in the latest Status of EU Protected Habitats and Species in Ireland (Article 17 report) (NPWS 2025) in **Table 1-1**. The overall conservation status is assigned as Bad for 7140 Transition mire, 7210 Cladium fen, 7230 Alkaline fen and *Vertigo moulinsiana* [1016] in the Article 17 report.

Table 1-1: National pressures to fen habitats

Habitat	Importance	Pressure
7140 Transition mire	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
	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)

Habitat	Importance	Pressure
		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)
7210 Cladium fen	High	PA05 Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming) PA17 Agricultural activities generating pollution to surface or ground waters (including marine) PL02 Drainage (mixed or unknown drivers)
	Medium	PA06 Mowing or cutting of grasslands PA08 Extensive grazing or undergrazing by livestock PB24 Drainage for forestry
	Low	PA01 Conversion into agricultural land (excluding drainage and burning) PA07 Intensive grazing or overgrazing by livestock PA22 Drainage for use as agricultural land PB19 Forestry activities generating pollution to surface or ground waters (including marine) PB26 Other forestry activities, excluding those relating to agro-forestry PF05 Sports, tourism and leisure activities PI03 Problematic native species PI01 Invasive alien species of Union concern
	High	PA07 Intensive grazing or overgrazing by livestock PA22 Drainage for use as agricultural land PA23 Physical alteration of water bodies (including dams, channels, etc.) J01 Mixed source pollution to surface and ground waters
	Medium	PA01 Conversion into agricultural land (excluding drainage and burning)

Habitat	Importance	Pressure
7230 Alkaline fen		PA05 Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming) PA08 Extensive grazing or under grazing by livestock PB24 Drainage for forestry PC06 Dumping/depositing of inert and dredged materials from terrestrial and marine extraction PF06 Deposition and treatment of waste/rubbish from built-up areas PI02 Other invasive alien species (other than species of Union concern) PL02 Drainage (mixed or unknown drivers) to surface or ground waters N02 Droughts and decrease in precipitation due to climate change N03 Increases or changes in precipitation due to climate change
	Low	PF05 Sports, tourism and leisure activities PI03 Problematic native species PE09 Land, water and air transport activities not referred to above PE01 Roads, paths, railroads and related infrastructure PC05 Peat extraction PA17 Agricultural activities generating pollution to surface or ground waters (including marine) PA20 Livestock farming generating pollution PB19 Forestry activities generating pollution to surface or ground waters (including marine) PB26 Other forestry activities, excluding those relating to agro-forestry
Vertigo moulinsiana	High	PA07 Intensive grazing or overgrazing by livestock PL02 Drainage (mixed or unknown drivers) PL05 Modification of hydrological flow (mixed or unknown drivers) PM07 Natural processes without direct or indirect influence from human activities or climate change

Habitat	Importance	Pressure
	Low	PH08 Other human intrusions and disturbance not mentioned above

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.
- Regulation (EU) 2024/1991 of the European Parliament and of the Council of June 2024 on nature restoration and amending Regulation (EU) 2022/869.
- 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.
- 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.
- Wildlife Acts 1976 to 2017, hereafter referred to as the Wildlife Acts; and
- Flora (Protection) Order, 2015 (S.I. No. 356 of 2015).

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 SACs and Special Protection Areas (SPAs).

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 bringing back 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. Member States are required to implement restoration measures for specific habitats and species, including marine ecosystems, forests, wetlands, and pollinators.

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 QI s of the SAC and Special Conservation Interest (SCI) of SPA sites. Conservation objectives for the site are defined for these QI s.

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 their favourable conservation status.

1.5 Outline of this FRP document

- Section 2 of this FRP report outlines the details of the Kilnaseer site and relevant details regarding the River Barrow and River Nore SAC.
- Section 3 outlines the findings from the land and water desktop and site monitoring surveys that were carried out to inform the development of these 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 by this FRP report that are impacting on fen.
- Section 6 outlines the key restoration measures proposed by this FRP.
- Section 7 outlines additional considerations to inform the development of the FRP.
- Section 8 outlines key players in the FRP, 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 (see Appendix D for details of GIS layers provided). 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. Regarding maps presented, and following consultation with NPWS, due to the sensitivity of many of the species recorded or referenced, species names have been omitted from Map legends. This is to ensure no confidential or highly sensitive locations are revealed which might result in negative impacts. GIS Shapefiles which accompany this report include all relevant data on referenced species.

2 Site Overview

2.1 Kilnaseer

Kilnaseer (Laois) is a site located 5 km east of Rathdowney in a lowland landscape of improved pasture. The site is within the boundary of the River Barrow and River Nore SAC (Site Code 002162).

The primary habitats across the site occur in the form of a mosaic of Annex quality 7140 Transition mire and 7230 Alkaline fens with small patches of 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* present within the 7230 Alkaline fens habitat in the northern area of the site. Kilnaseer occurs at an elevation of 79 mOD within a lower lying basin and is surrounded by hillslope at 87 mOD to the north-east and south-west and gentle within the centre. Figure 2-1 outlines the location and extent of the Kilnaseer site as well as the extent of the overlapping area with the River Barrow and River Nore SAC.



Figure 2-1: Site Location Map

The SAC is located within the Nore Catchment and is primarily drained by tributaries of the Erkina River. For the purposes of the Water Framework Directive the Kilnaseer site and SAC is located within the Nore sub-catchment.

2.2 Fen Condition Assessment

As detailed in Table 2-1 the following three pressures have been reported across the site in the NFS in 2022. These pressures have been categorised in line with the EU Commission pressure and threat classification system.

Table 2-1: Assessment of impacts of pressures on 7140, 7210, and 7230 at Kilnaseer

Pressure Code	Pressure [sub-category]	Influence
PA08	Undergrazing is allowing vegetation to go rank, negatively influencing the species composition of fen habitat on site.	Negative
PI	Problematic native species in the form of encroaching scrub has been noted as a pressure within the site.	Negative
K02	Drainage. This is considered to be a facilitating the encroachment of scrub across the site.	Negative

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

Kilnaseer was surveyed as part of the NFS on 18th August 2022. The structure and functions of 7140 Transition mire, 7210 Cladium fen, and 7230 Alkaline fen habitat on site were assessed as Unfavourable – Bad, Favourable, and Unfavourable – Bad, respectively. Neither area, future prospects nor overall status were assessed. No further details in relation to the conservation status assessment of the habitats carried out as part of the NFS was available at the time of writing.

2.3 Site-specific conservation objectives

Detailed SSCOs aim to define the conditions necessary to maintain or achieve the favourable conservation condition of a habitat or species at site level. The maintenance of habitats and species within sites at favourable condition will contribute to the maintenance of favourable conservation status of those habitats and species at a national level.

Fen habitats present within the site include 7140 Transition mire, 7210 Cladium fen and 7230 Alkaline fen, all of which are Annex I habitats. However, these fen habitats are not QIs of the SAC and therefore do not have statutory SSCOs defined for Kilnaseer.

Statutory conservation objectives have been published for the River Barrow and River Nore SAC for the QIs relevant to Kilnaseer, namely 91E0 Alluvial forests and *Vertigo moulinsiana*. Maintaining habitats and species in good ecological condition within Kilnaseer will contribute to the achievement of these SAC conservation objectives and to favourable conservation status at a national level.

For the purposes of this FRP, attributes and targets derived from NPWS guidance for Annex I fen habitats have been applied as restoration benchmarks for 7140 Transition mire[3], 7210 *Cladium* fen[4] and 7230 Alkaline fen[5]. These benchmarks are used to guide restoration planning and to assess ecological outcomes at site level and do not represent SAC SSCOs for Kilnaseer.

The restoration actions outlined in this FRP aim to contribute towards achieving these benchmark targets by improving hydrological conditions, reducing nutrient inputs and restoring vegetation structure and composition. This document does not present the full suite of attributes and targets for the Annex I fen habitats present. Instead, the selection provided reflects a conscious decision to focus on those attributes with clear, direct links to the proposed restoration measures. It is anticipated that additional attributes and targets will also benefit indirectly as restoration measures are implemented.

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

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution 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 site. 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

[3] Conservation Objectives for Scragh Bog - 7140 Transition mires and quaking bogs have been adapted for Kilnaseer.

[4] Conservation Objectives for Pollardstown Fen SAC – 7210 *Cladium* fen have been adapted for Kilnaseer.

[5] Conservation Objectives for Fin Lough SAC lough– 7230 Alkaline fen have been adapted for Kilnaseer.

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
				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	Centimetres; 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: hydrology – flow patterns	Flow direction	Maintain appropriate topography and water movement regime 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: 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

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
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	habitat. 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: 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 2m monitoring stops	Cover of disturbed bare ground not more than 10%	Yes	
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	

Table 2-3: Attributes and Targets for Alkaline Fens [7230] (NPWS, 2019)

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Habitat distribution	Occurrence	No decline, subject to natural processes	Yes	Yes. FRP actions will not result in a decline in distribution of fen habitat within the site. In fact, it will contribute to the increase of 7230 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. FRP actions will address nutrient input from surrounding land which will assist in the restoration of more natural nutrient conditions.
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain active peat formation, where appropriate	Yes	Yes. Improvement in the hydrology of fen habitat will improve conditions for peat formation.
Ecosystem function: hydrology – groundwater levels	Water levels (centimetres); duration of levels; hydraulic gradients	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Yes	No
Ecosystem function: hydrology - surface water flow	Drain density and form	Maintain, or where necessary restore, as close as possible to natural or semi- natural drainage conditions	Yes	No

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Ecosystem function: water quality	Water chemistry measures	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitats	Yes	Yes. FRP actions will include the engagement with landowners for best practice regarding land management to reduce nutrients entering the site. Water quality monitoring will be carried out within the site.
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Yes	The restoration measures seek to have a positive impact on the vegetation structure and composition of 7230 Alkaline fens. Subsequently, all attributes should see a favourable shift towards their respective targets.
Vegetation composition: brown mosses	Percentage cover at a representative number of 2m x 2m monitoring	Maintain adequate cover of typical brown moss species	Yes	
Vegetation composition: typical vascular plants	Percentage cover at a representative number of 2m x 2m monitoring stops	Maintain adequate cover of typical vascular plant species	Yes	
Vegetation composition: native negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of 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	
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Yes	

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Vegetation composition: soft rush and common reed cover	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of soft rush (Juncus effusus) and common reed (Phragmites australis) less than 10%	Yes	
Vegetation structure: litter	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of litter not more than 25%	Yes	
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground not more than 10%	Yes	
Physical structure: tufa formations	Percentage cover in local vicinity of a representative number of monitoring stops	Disturbed proportion of vegetation cover where tufa is present is less than 1%	Indirectly	Areas of tufa are not the target of restoration measures and monitoring. However, measures look to improve the condition of fen habitats which may indirectly positively affect vegetation in areas.

Table 2-4: Attributes and Targets for 7210 *Cladium* fen (NPWS, 2022)

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Yes	Restoration measures are designed to prevent further degradation of fen habitat and improve hydrological conditions, which may support stabilisation and, where conditions allow, expansion of fen habitat extent.
Habitat distribution	Occurrence	No decline, subject to natural processes	Yes	The FRP does not propose actions that would result in loss of fen habitat. Measures to improve hydrology and manage scrub are expected to reduce pressures contributing to habitat contraction.
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	Measures addressing hydrological regime and engagement with surrounding land management are expected to reduce nutrient inputs and support more natural nutrient conditions within the fen.
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain active peat formation, where appropriate	Yes	Restoration measures aimed at raising and stabilising water levels are expected to improve conditions for peat-forming vegetation and support peat accumulation where appropriate.

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Ecosystem function: hydrology – groundwater levels	Water levels (centimetres); duration of levels; hydraulic gradients; water supply	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Yes	Drain management and hydrological restoration measures are designed to improve groundwater levels and hydrological connectivity across the site, supporting fen structure and function.
Ecosystem function: hydrology – surface water flow	Drain density and form	Maintain, or where necessary restore, as close as possible to natural or semi-natural drainage conditions	Yes	Proposed drain blocking and flow attenuation measures aim to reduce artificial drainage and move surface water conditions closer to semi-natural regimes.
Ecosystem function: water quality	Various	Maintain, or where necessary restore, appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	Yes	Hydrological restoration and catchment-scale engagement measures are expected to reduce nutrient mobilisation and improve overall water quality entering and within the fen system.
Vegetation composition: cover of *Cladium mariscus*	Percentage cover at a representative number of monitoring stops	Cover of *Cladium mariscus* at least 25%	Indirectly	Improved hydrological conditions and reduced nutrient enrichment are expected to favour fen specialist species such as *Cladium mariscus*, where present, over more competitive grasses and reeds.
Vegetation composition: typical vascular plants	Percentage cover at a representative number of monitoring stops	Maintain adequate cover of typical vascular plant species	Yes	Vegetation management and hydrological restoration are expected to support recovery of characteristic fen plant communities and improve overall species composition.

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Vegetation composition: native negative indicator species	Percentage cover at a representative number of monitoring stops	Cover of native negative indicator species at insignificant levels	Yes	Scrub management and improved hydrological conditions are expected to reduce the dominance of native negative indicator species associated with drainage and nutrient enrichment.
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Cover of non-native species less than 1%	Yes	The FRP does not introduce pathways for non-native species and includes monitoring and management measures that would allow early detection and control if required.
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Yes	Targeted scrub management measures directly address excessive encroachment of native trees and shrubs within fen habitat.
Vegetation composition: soft rush and common reed cover	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of soft rush (Juncus effusus) and common reed (Phragmites australis) less than 10%	Yes	Hydrological restoration and vegetation management are expected to reduce conditions that favour expansion of soft rush and common reed within fen habitats.
Vegetation structure: litter	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of litter not more than 25%	Indirectly	Improved grazing suitability and vegetation structure following restoration are expected to reduce litter accumulation over time.

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Vegetation structure: vegetation height	Percentage cover of representative number of monitoring stops	At least 10% of live shoots more than 1 m high	Yes	Restoration measures aim to support a structurally diverse fen vegetation mosaic, including taller fen species, where appropriate.
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of disturbed bare ground not more than 10%	Yes	The FRP does not involve activities that would increase bare ground and includes measures designed to stabilise peat surfaces and vegetation cover.
Physical structure: tufa formations	Percentage cover in local vicinity of a representative number of monitoring stops	Disturbed proportion of vegetation cover where tufa is present is less than 1%	Indirectly	No direct works are proposed in areas of tufa; however, improved hydrological and ecological conditions may indirectly support tufa-associated vegetation where present.
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population size of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	Yes	By improving habitat condition and reducing key pressures, the FRP is expected to maintain or enhance conditions for species of local conservation interest.
Transitional areas between fen and adjacent habitats	Hectares; distribution	Maintain/restore adequate transitional areas to support/protect the *Cladium* fen habitat and the services it provides	Yes	Hydrological restoration and scrub management are expected to improve the condition and functionality of transitional zones between fen and adjacent habitats.

3 Land and Water

3.1 Desktop 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 Met Éireann weather station, Parknahown Cullahill, have been reviewed to assess seasonal variability in rainfall at the site and surrounding areas (Met Éireann, 2025).

Two datasets have been visualised: (1) average monthly precipitation (mm), incorporating a 30 -year period to show seasonal distribution patterns (Figure 3-1) and (2) total annual precipitation (mm) for each year within the 30-year record (Figure 3-1), to identify longitudinal trends. This information is important to assess water availability and to evaluate the feasibility and sustainability of restoration actions aimed at restoring or maintaining suitable hydrological conditions.

The average monthly rainfall is highest in the winter months (October to January) and lowest in late spring (April and May). Minimum rainfall follows a similar pattern, while the maximum monthly rainfall shows a notable increase in winter (Figure 3-1).

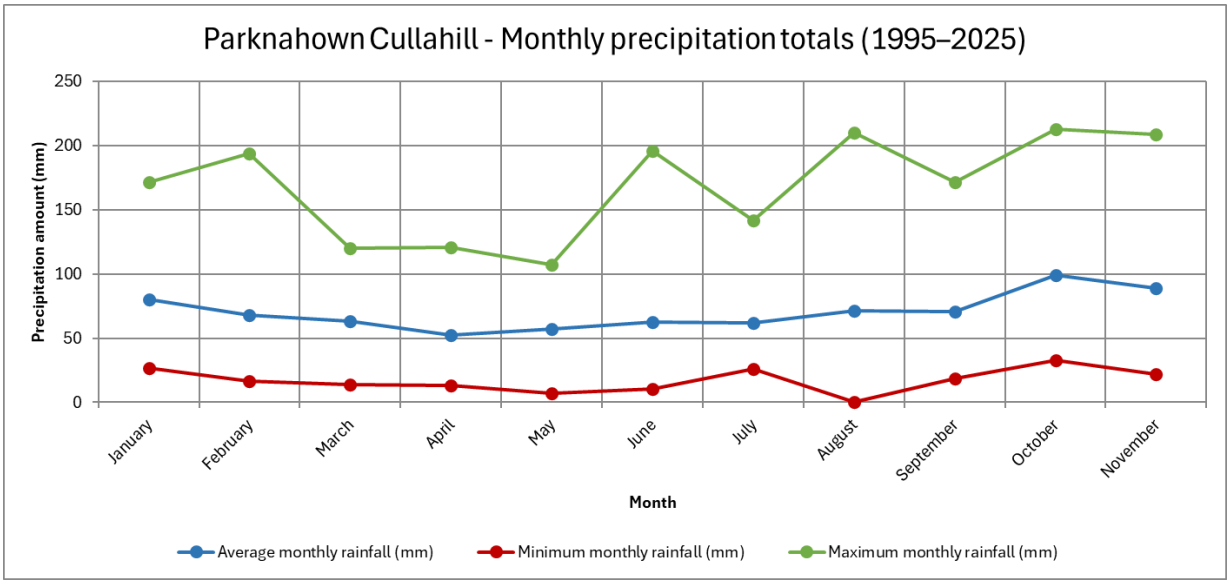


Figure 3-1 Parknahown Cullahill OPW weather Station – Total annual precipitation within the last 30 years (1955-2025)

3.1.2 Hydrogeological Setting

The west of the site is underlain by the Aghmacart Formation, characterised by dark grey, fine- to medium-grained limestone, locally argillaceous, with occasional shale partings, of Lower Carboniferous age. The bedrock geology of the site is presented in (Figure 3-2).

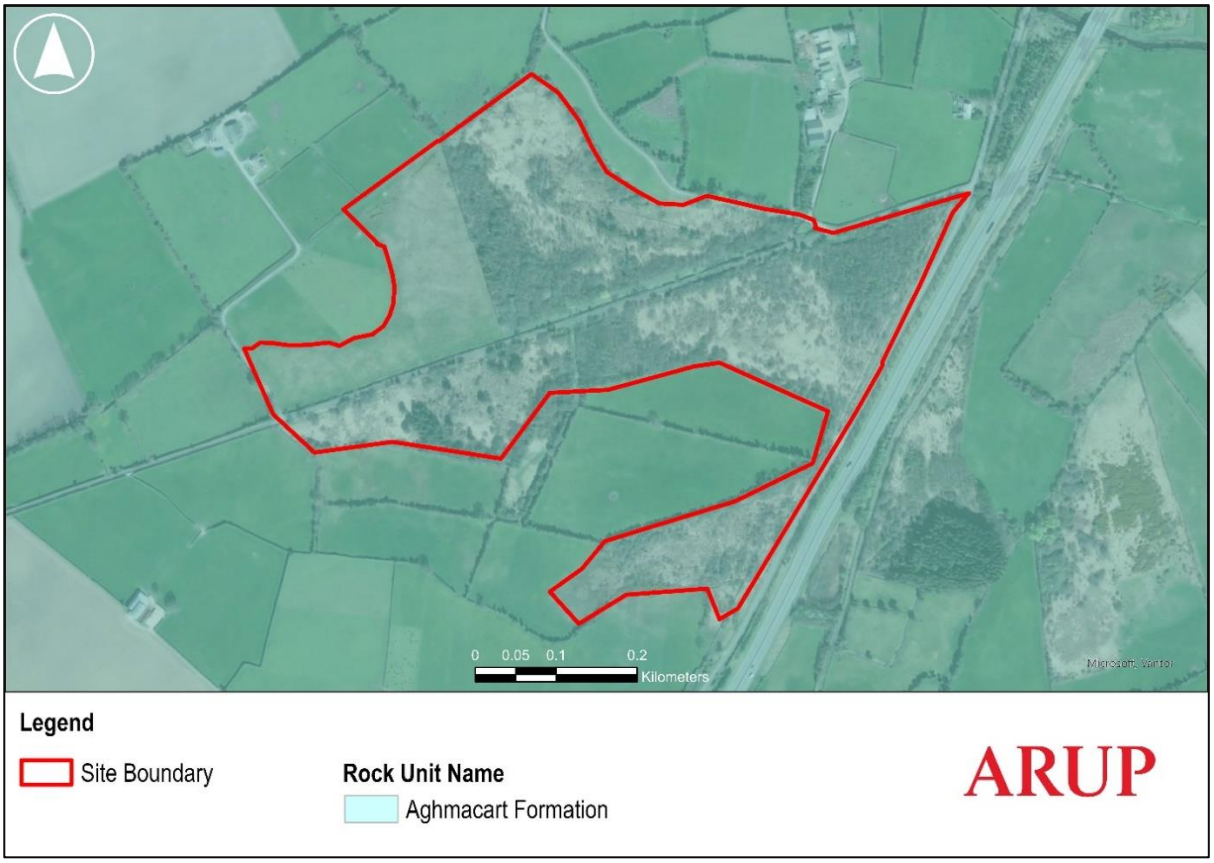


Figure 3-2 Bedrock Geology of Kilnaseer

The area is underlain by a Locally Important bedrock aquifer which is moderately productive only in local zones (LI). Most of the flow in this type of aquifer is in the upper 15m, in the zone that consists of a weathered layer and connected fracture zone below. A locally Important aquifer (Lm) is located west of the site and is characterised by limited groundwater storage and low permeability. The aquifer classification underlying the site is presented in Figure 3-3.



Figure 3-3 Aquifer classification and karst underlying Kilnaseer

Quaternary sediments within the site boundary comprise predominantly fen peat, with limestone-derived till present around the site perimeter and a localised area of gravel derived from Limestone. The surrounding area is underlain mainly by limestone-derived till, with a band of alluvium north of the site interspersed with areas gravel derived from with Limestone. To the west some bedrock crops and an area of lacustrine sediments. The gravel deposits predate the peat, having formed through glacial retreat, whereas the peat accumulated in the post-glacial, warmer climatic period. The subsoil type underlying the site is presented in Figure 3-4**.**

Soil type in Kilnaseer observed during the NFS included peat with depths ranging from 1 m to 2.2 m. The Teagasc soils map notes that soil types within the site are mostly fen peat (93.2 %), Shallow poorly drained mineral (mainly basic)-(3.4 %), Peaty poorly drained mineral (mainly basic)-(1.8 %), Mineral poorly drained (mainly basic)-(1.2 %), Deep well drained mineral (mainly basic)-(0.4 %), with smaller areas in the site's northern and eastern fringes of shallow poorly drained mineral soil.

Groundwater vulnerability ranges from moderate in peat-covered areas to high in areas underlain by gravel, with an area of extreme vulnerability in the south-east where rock is near or at surface or karst is present. This pattern is reflected by the recharge rates, which are higher in gravels (400 to 450 mm/year), and lower in the peat (1 to 50mm/year). The groundwater vulnerability for the site is presented in Figure 3-5.

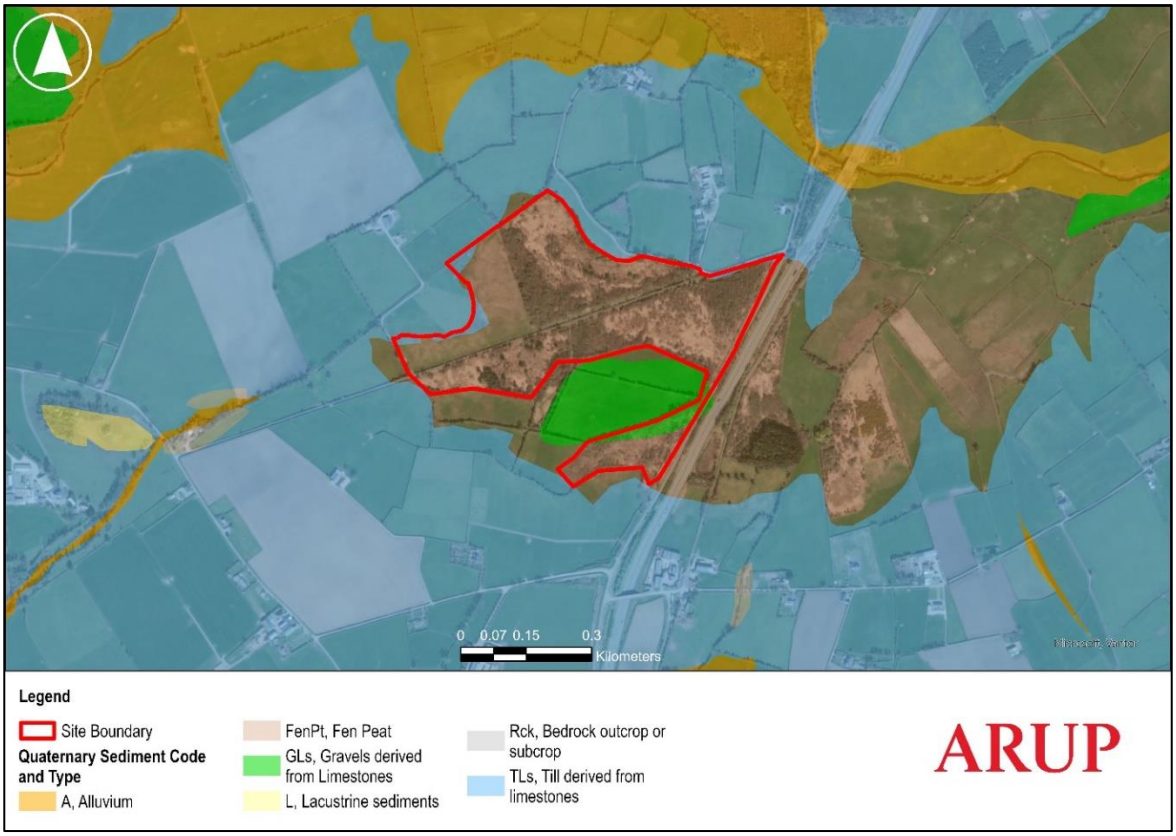


Figure 3-4: Sub-soil type underlying Kilnaseer (Source: GSI Quaternary map)

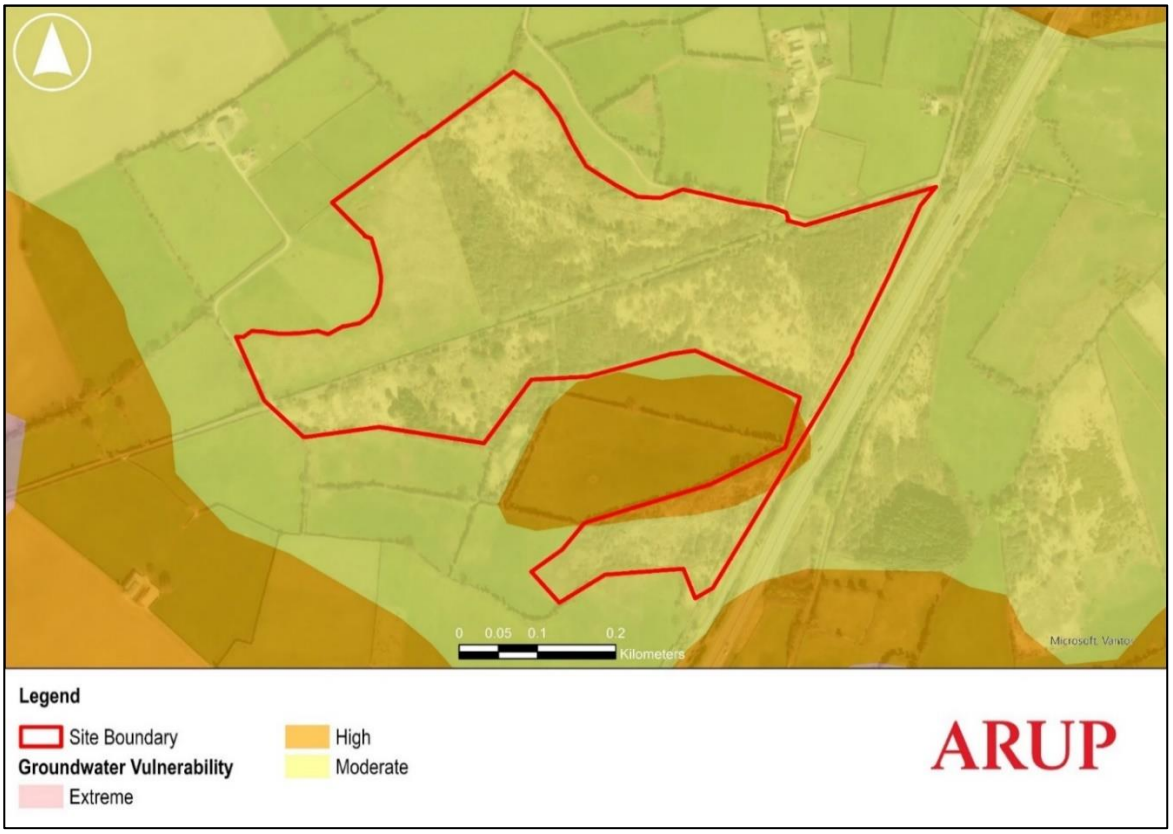


Figure 3-5: Groundwater vulnerability map for Kilnaseer (Source: GSI)

3.1.3 Topographic and Surface Water Drainage

The site is located within the Nore Catchment (Catchment ID:15) and the WFD Catchment sub catchment: Nore_SC_050. The Nore Catchment drains towards the Nore Estuary and then to the Irish Sea at Waterford harbour. The WFD River Sub-Basin: ERINKA_050 drains the site to the east towards River Nore (Figure 3-6). Under the third River Basin Management Plan (The ERINKA_050 WFD River waterbody is classed at 'moderate' WFD Status and 'at risk' of not achieving its WFD objective. The Rathdowney Groundwater Body, which underlies the site is at 'good' status and 'not at risk' of not achieving its WFD objectives.



Figure 3-6: WFD Catchment and River sub-basin (EPA, 2025)

The site is positioned at approximately 79 mOD to 86 mOD and is within a depression with higher ground northeast and southwest on surrounding hillslopes (Figure 3-7). The site is relatively flat within the centre. Farms extend around the boundary, and the fen vegetation is distinct from agriculture land use (Figure 3-8).

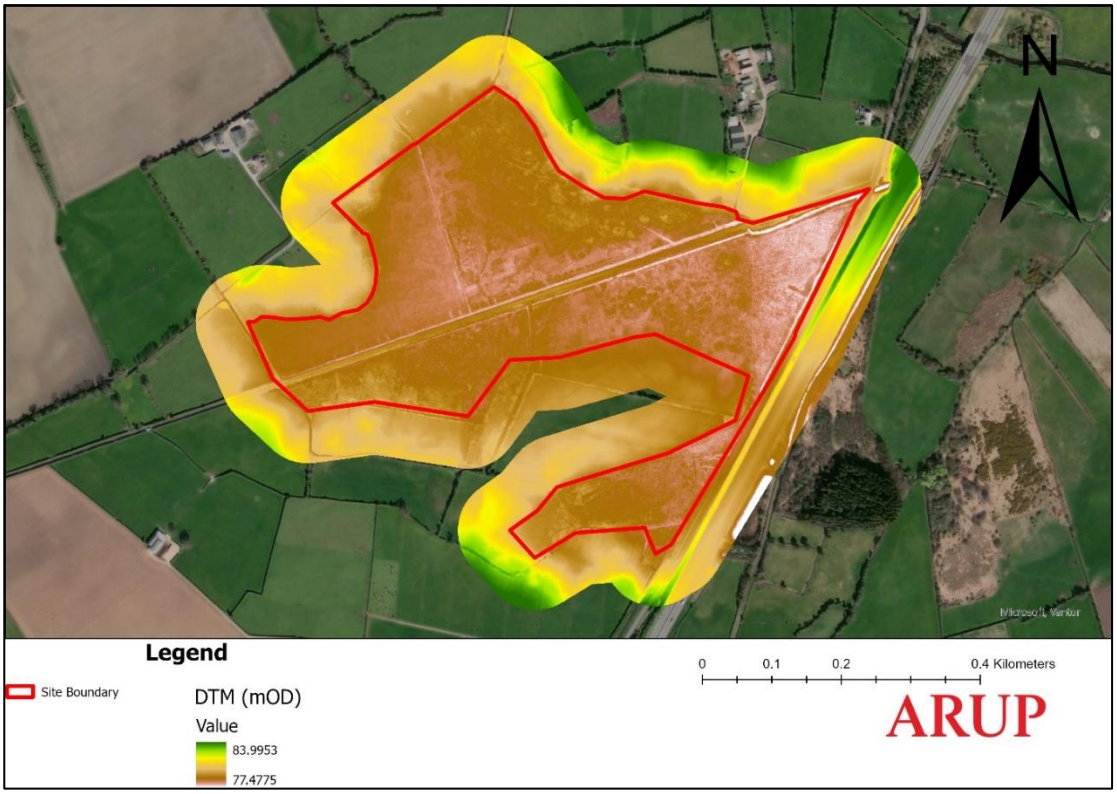


Figure 3-7 Topographic DTM (LiDAR) map of Kilnaseer



Figure 3-8: Topographic ortho image of Kilnaseer

The drainage of the site has gone through various modifications over the years. The 25-inch map from 1897-1913 indicates that there was a spring to south-west of the site that was redirected towards a reservoir at Carrick House (Figure 3-9). The flow was then controlled by a sluice to be directed into a mill race. Flow from the mill race was directed around the wetland system from the west to east to join a tributary of the Erkina River. The wetland system is part of the River Barrow and River Nore SAC and had multiple spring inputs on the southern edge of the system.

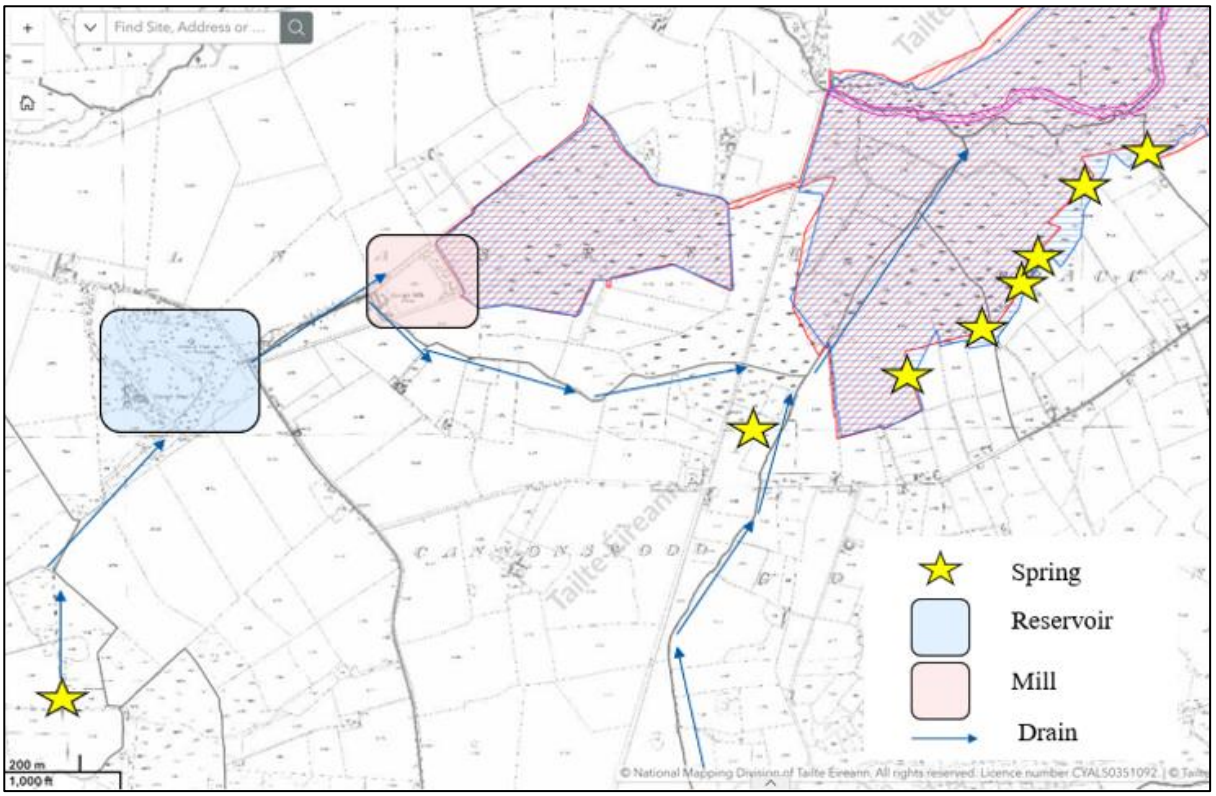


Figure 3-9: Historical water distribution and retention within wetland (Tailte Éireann Historical mapping)

Since the historical drainage for a mill race there has been arterial drainage for the Drainage District in the 1940s managed by Laois County Council (Figure 3-10). This formalised drainage within the wetland and created deep arterial drains along the local road from west to south of the wetland to be directed to a tributary of the Erkina River.

More recently the drainage efficiency was increased through the upgrade to the M8 in 2010 (Figure 3-11). The upgraded road disconnected the wetland from the western system and increased drainage efficiency through upgrading the culvert at the road. There is also an attenuation pond on the opposite side of the upgraded road, which is likely related to the upstream spring in that area.



Figure 3-10: Drainage district drainage of Kilnaseer (Source: OPW, 2025)



Figure 3-11: Kilnaseer prior to M8 upgrade in 2008 (left) and after M8 upgrade in 2010 (right) (Source: Google Earth imagery)

The current drainage follows the arterial drainage records from Floodsinfo.ie. The OSI and EPA river lines follow the historical drainage direction. The ERINKA_050 River located west of the site, acts as the main surface water inflow to Kilnaseer, to the west, with the outflow directed under the M8 (Figure 3-12). There are large drains on either side of the local road and the national road. There are also smaller drains directing flow from the fen to these larger drains.

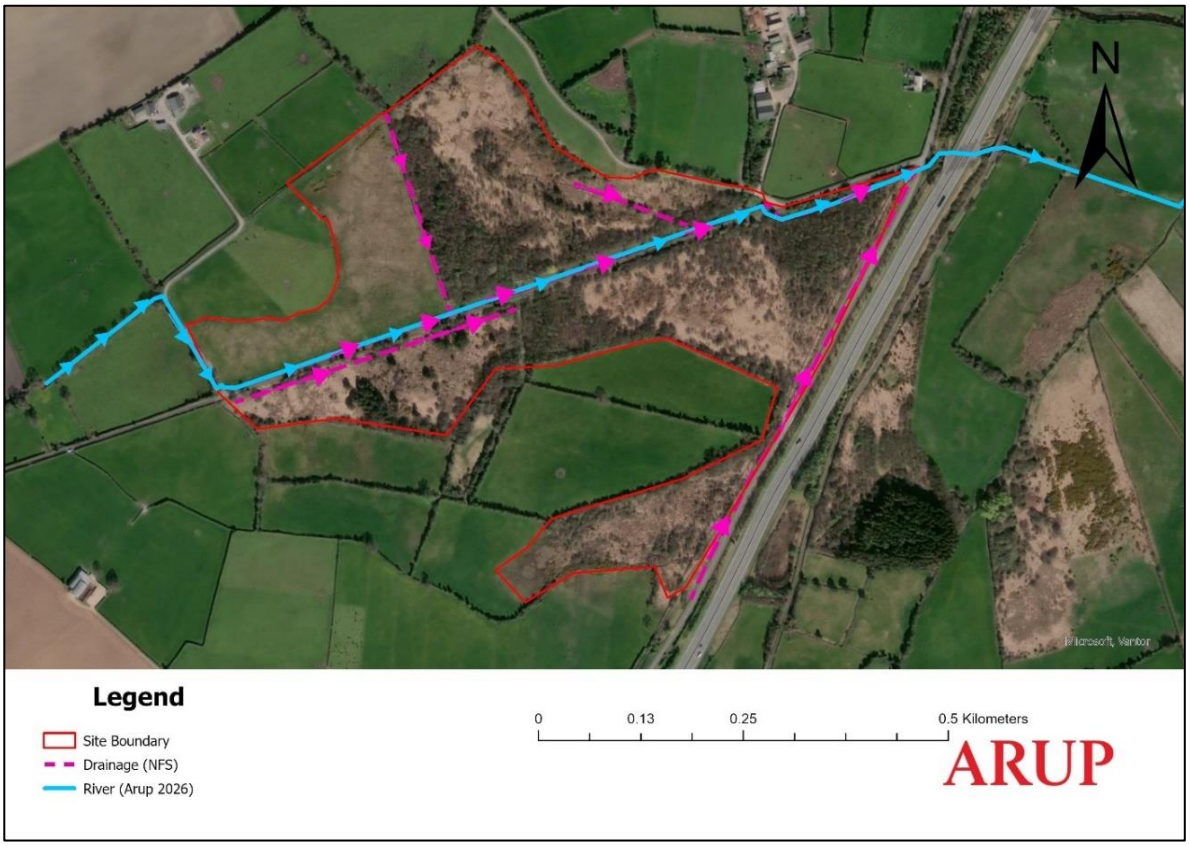


Figure 3-12: Mapped drainage network of Kilnaseer

The mapped Wetness Index[6] classifies the site as temporarily wet, indicating alternating periods of saturation and dryness between 2012 and 2018. This pattern suggests a mosaic of variable soil moisture conditions, supporting intermittent wetland characteristics across the site (Figure 3-13).

Total productivity mapping for Kilnaseer further illustrates the site's hydrological variability. Most of the area is classified as having high productivity, which is characteristic of artificial drainage and agricultural use. The north-east and south-west of the site show moderate productivity, typically associated with semi-degraded peatland habitats impacted by drainage and vegetation encroachment.

[6] Dataset available at 10m resolution indicating the occurrence of water and wet surfaces over the period from 2012 to 2018.

Areas of high total productivity within known peatland areas can indicate disturbance. Areas of elevated productivity within mapped peatland extents indicate altered peatland function, including lowered water tables, increased aerobic decomposition of peat, and a transition away from peat-forming vegetation communities. This pattern suggests that, while peat soils remain present, their hydrological integrity and ecological condition have been compromised, resulting in reduced peatland functionality and resilience (Figure 3-14).

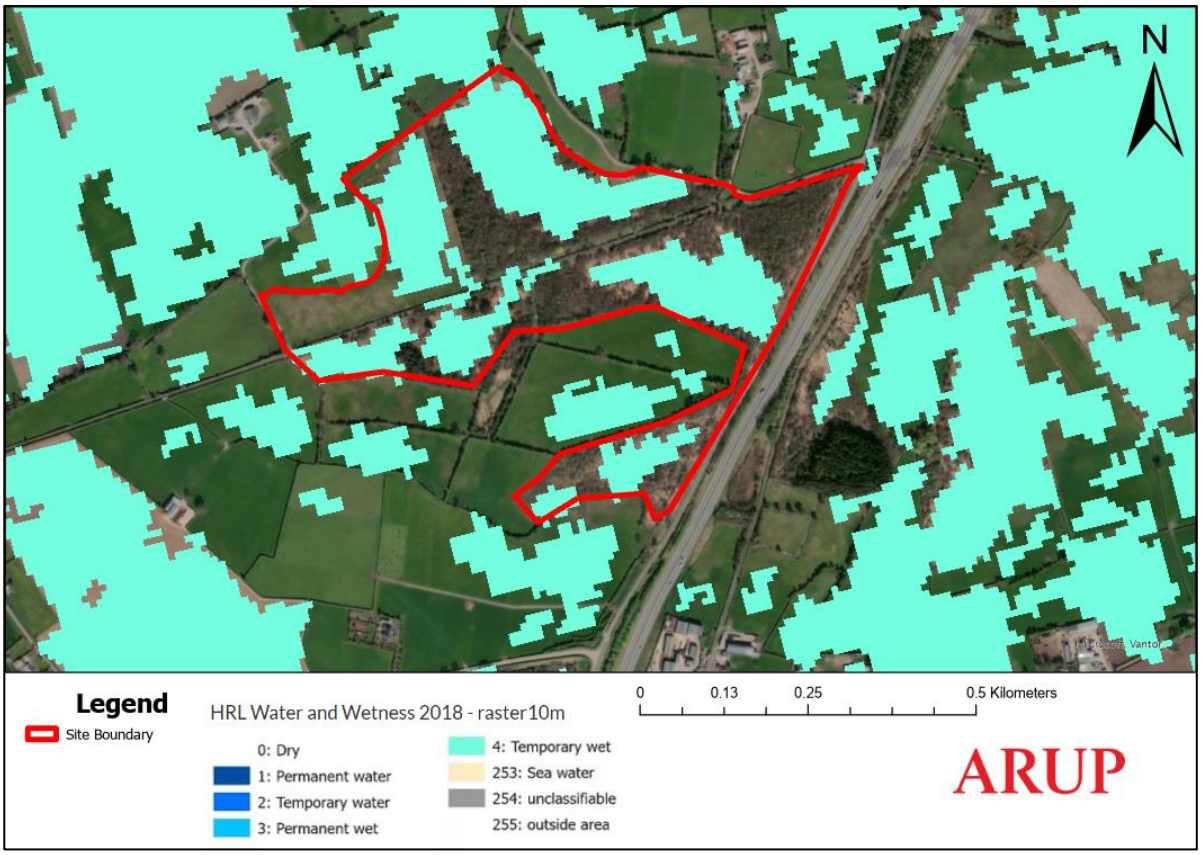


Figure 3-13: HRL Water and Wetness – 2018 of Kilnaseer (Copernicus, 2025)

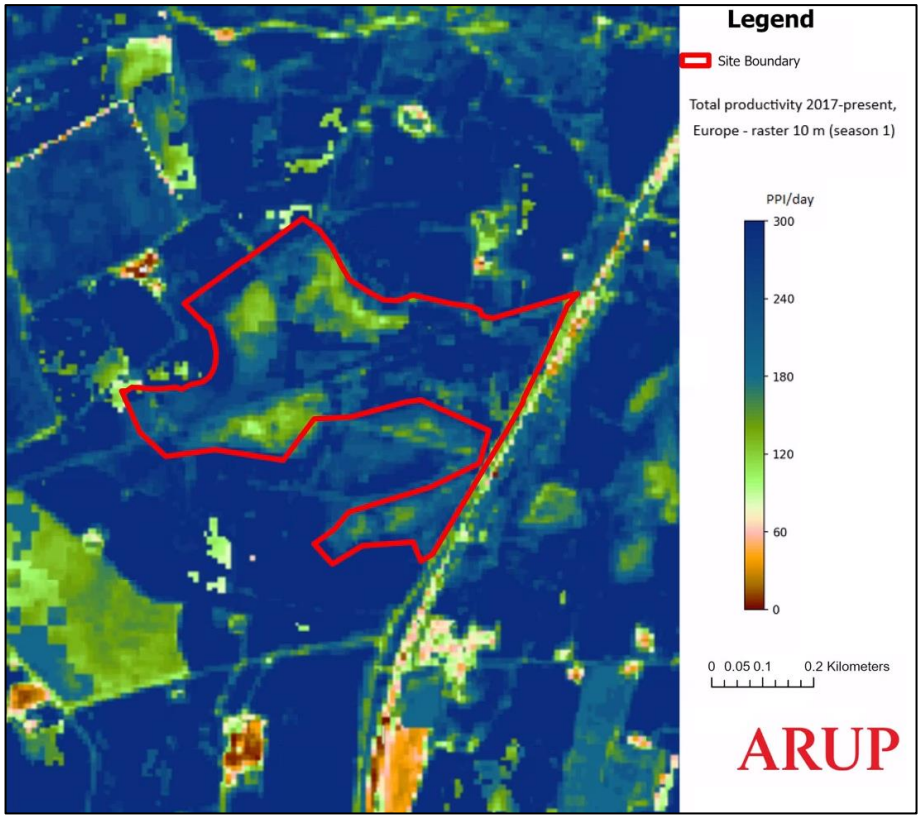


Figure 3-14: Total Productivity 2017 -present, Europe – raster 10m (season 1) of Kilnaseer (Copernicus, 2025)

3.1.4 Land use Pressures and Water Quality

Under the Erkina Priority Area for Action (PAA), Erkina_050 was identified as having levels of nutrients, nitrate and phosphate being too high[7]. These nutrients have caused a decline in water quality. Agriculture was identified as being the likely source of the elevated nutrient nitrate and phosphorus. The nature of the freedraining/light soils in much of this PAA is that they do not hold on to nitrate or phosphate applied as a fertiliser.

Pollution Impact Potential (PIP) maps (EPA 2025) are a tool used to indicate the highest risk areas in the landscape for transfer 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. This information is relevant to the SSCO attribute "Water quality – Nutrients" and informs assessment against the SSCO target to maintain nutrient levels and support favourable conservation condition for habitats.

High risk areas for phosphorus loss typically have poorly draining soils and dominant overland flow pathways. The PIP maps indicate that phosphorus delivery flow paths across the site

[7] AFA0074 Erkina AFA Report.pdf

range from medium to high risk, with areas of higher risk across the site (Figure 3-15). Within the site boundary there is very high PIP rankings (Figure 3-16)

When connected to the central fen drain these areas may provide a pathway for high phosphorus transfer. Near-surface nitrate susceptibility is predominantly low to moderate across the site, with limited areas of elevated susceptibility located towards the north-west and south-east margins (Figure 3-17). Subsurface nitrate susceptibility is generally low across the site, with some pockets of moderate susceptibility evident in the southern portion (Figure 3-18).

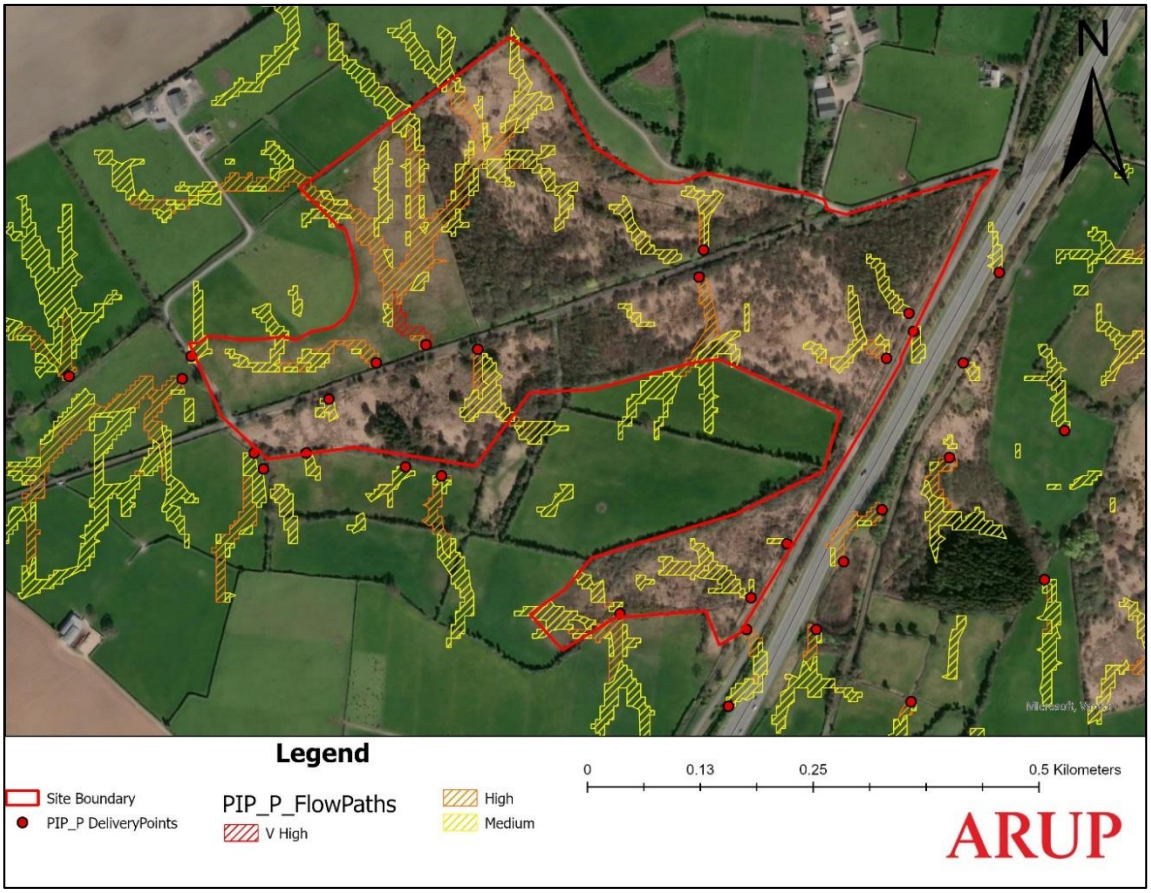


Figure 3-15: PIP- P - Flow delivery paths and points for Phosphorus at Kilnaseer (EPA, 2021)

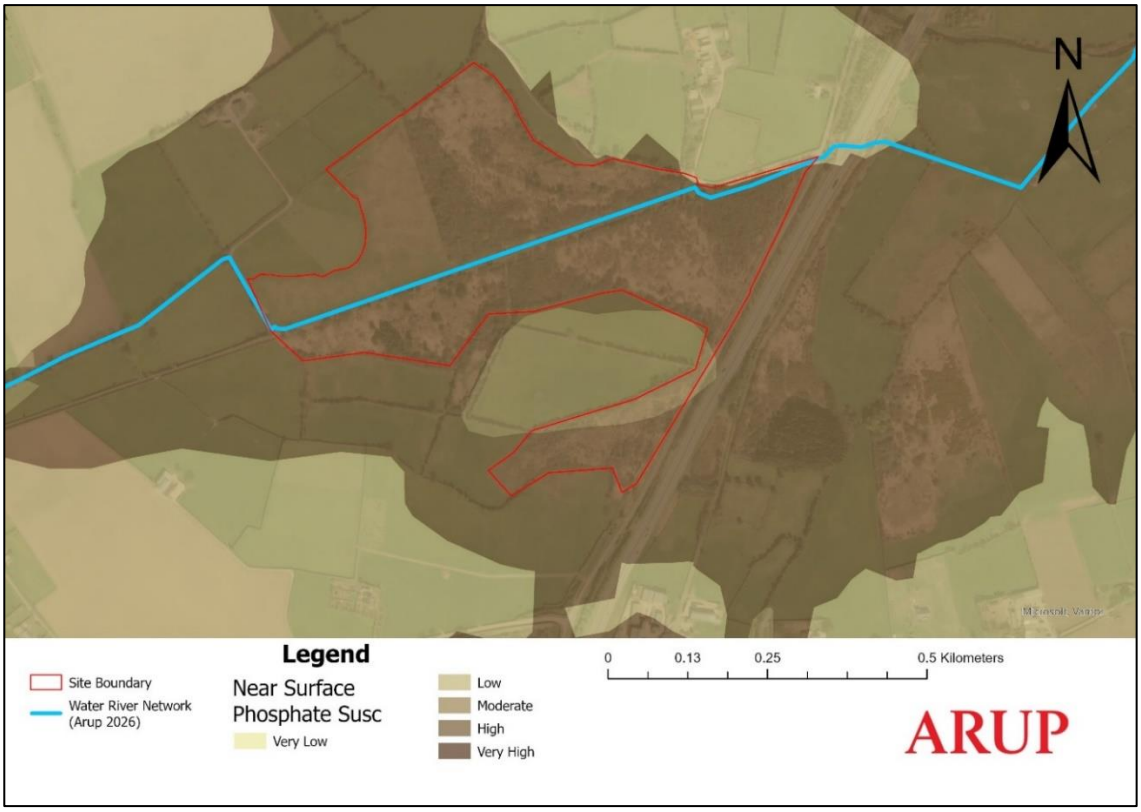


Figure 3-16: PIP maps (Phosphorus) at Kilnaseer

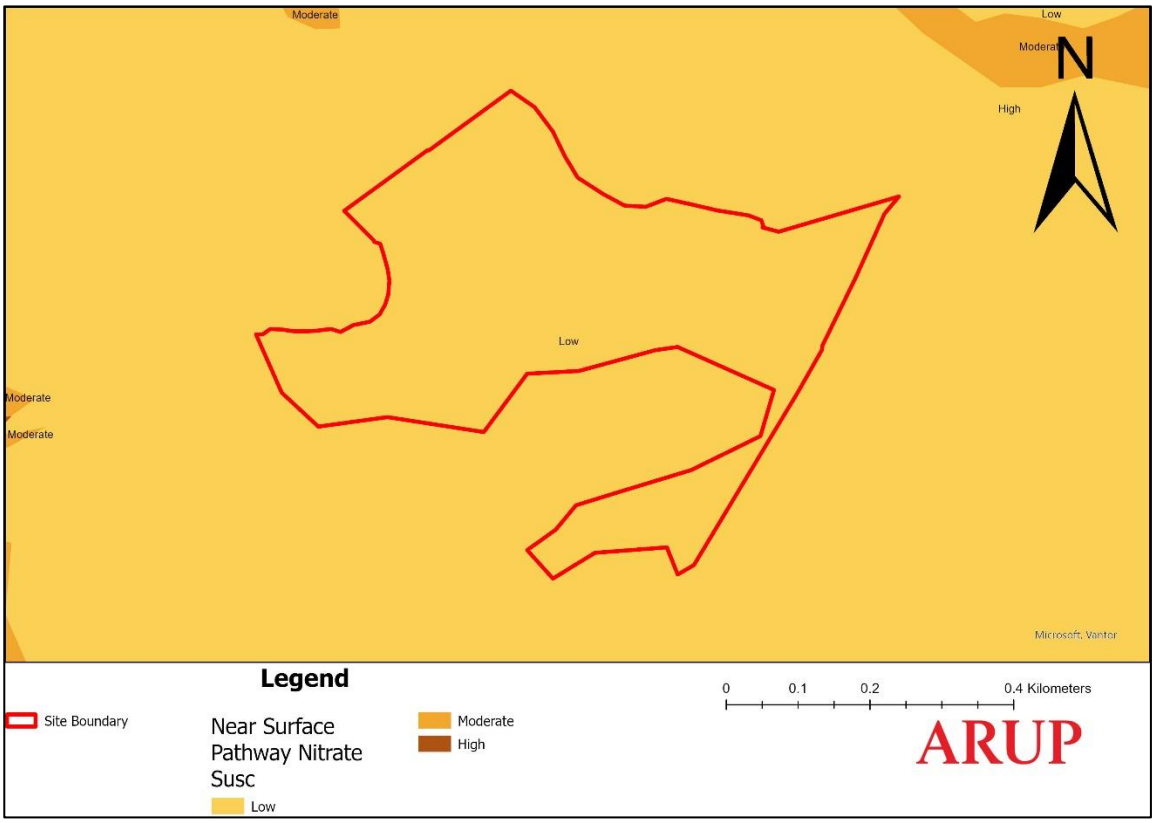


Figure 3-17: PIP maps (Near surface Nitrate Susceptibility) at Kilnaseer

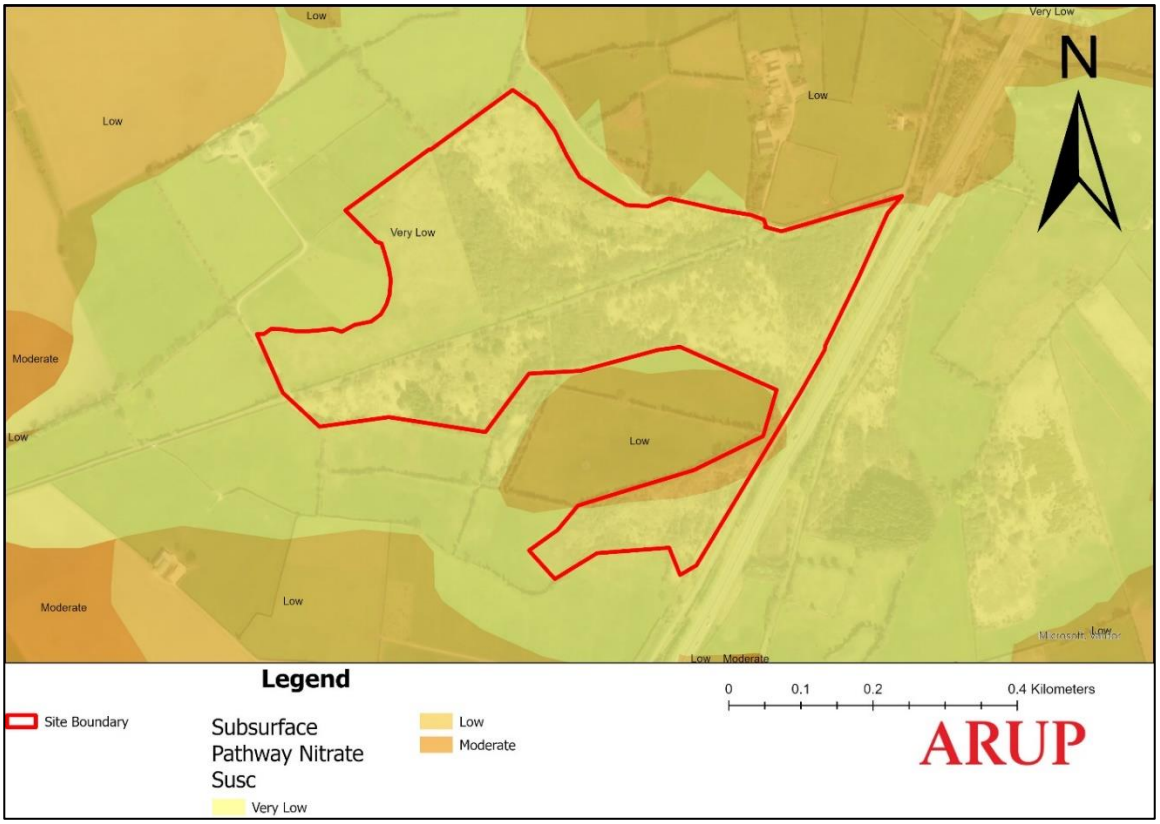


Figure 3-18: PIP maps (Sub surface Nitrate Susceptibility) at Kilnaseer

3.2 Field Survey

Site monitoring was undertaken in February 2026, focusing on developing the understanding of the water regime, pressures and implementation of restoration measures within the habitat. The site monitoring included peat depth probing, water quality monitoring and observations of water flow in the drainage network.

Water quality data were collected across multiple areas within and around the site, including fens and associated watercourses. The parameters recorded included pH, EC, temperature, dissolved oxygen (DO), nitrate, and phosphate. Peat depths were probed to assess substrate characteristics.

Field survey Monitoring locations are presented in Figure 3-19.

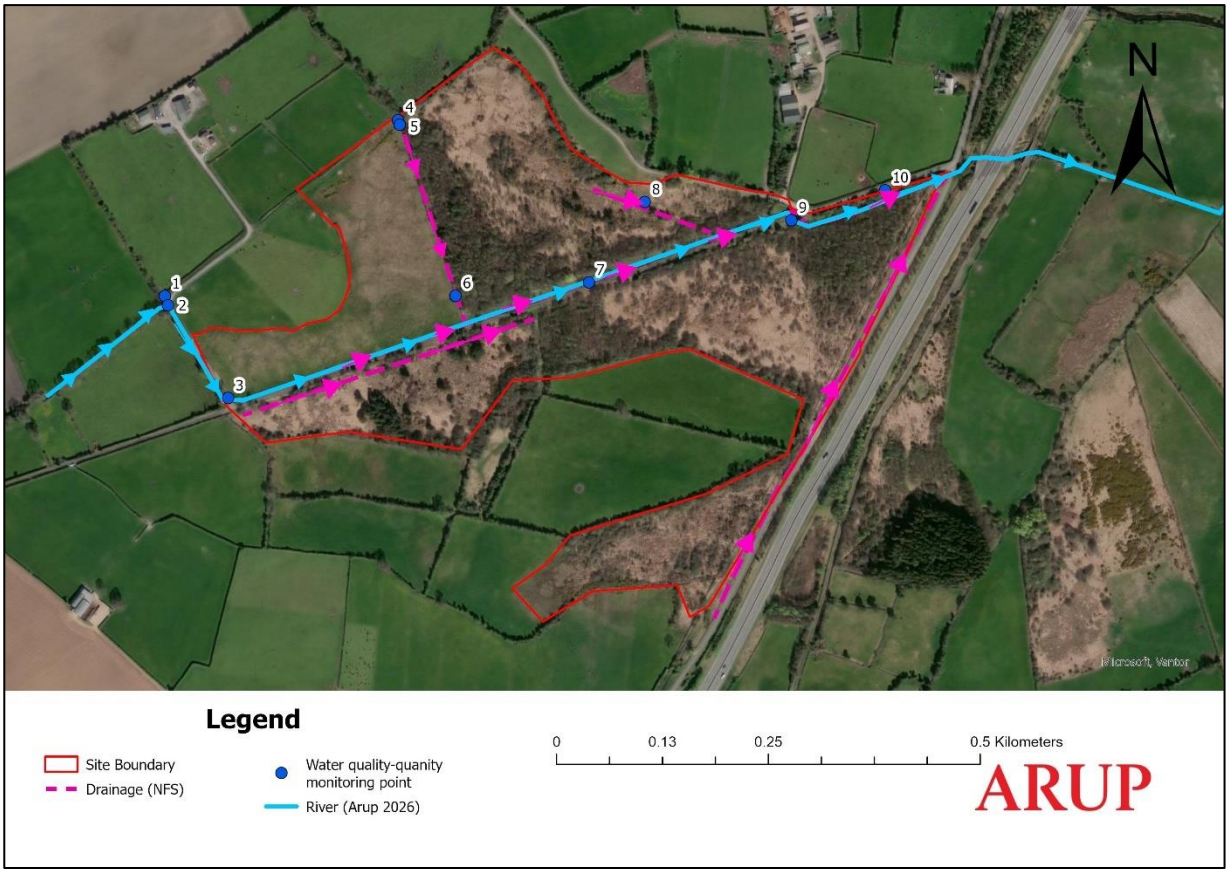


Figure 3-19: Baseline water monitoring point locations (1-10)

3.2.1 Peat Depth Probing and Ground Investigations

Within the site boundary, peat depths range from approximately 1.0 m in the northern area to around 2.0 m locally, with depths generally between 1.1 m and 1.4 m across the eastern and central areas, particularly surrounding the drainage in the fen. The shallow peat depth of 0.3 m is located outside the site boundary. Peat depths recorded during the site surveys are presented in Figure 3-20.

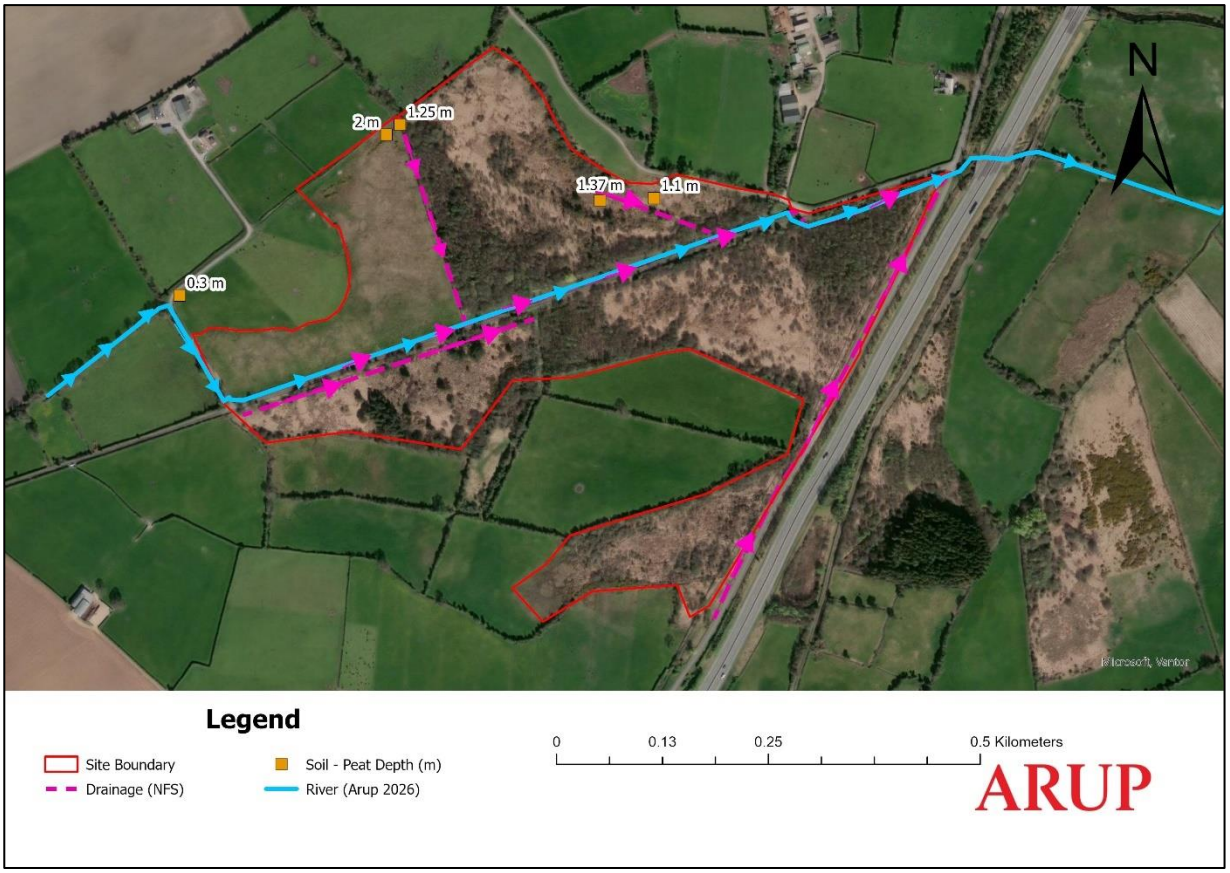


Figure 3-20: Peat depths (m) at Kilnaseer

3.2.1 Surface Water levels

The river that flows through Kilnaseer is an arterial drain that flows straight (west to east) to the west of the fen, with a sharp right to flow parallel to the road with a width of 2 m, under the road and within the site boundary expanding in width to 3 m and to 7 m where it flows parallel to the local road before passing beneath the M8 (Figure 3-21 and Figure 3-22).

A secondary fen stream that has a width of 2 m flows north to south through the centre of the site and discharges into the main drain. An additional field drain is present to the east, also connecting to the main drain with a width of 1.5 m. Downstream of the site, the drainage network continues beneath the M8 and discharges through the River Barrow and River Nore SAC and SPA.

The water level flowing into the site boundary is 0.75 m and the drain at output is 0.2 m, suggesting that the fen is retaining some water but is losing water.

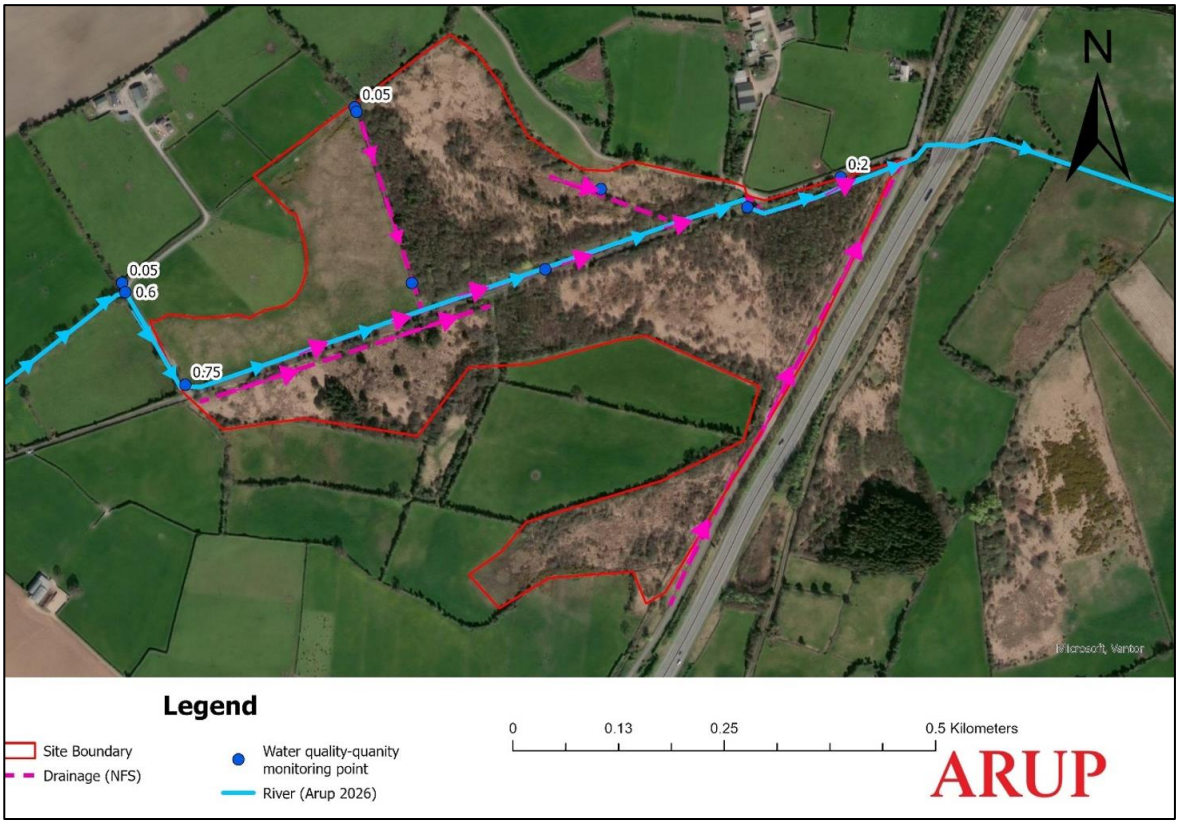


Figure 3-21: Water levels (m) at Kilnaseer

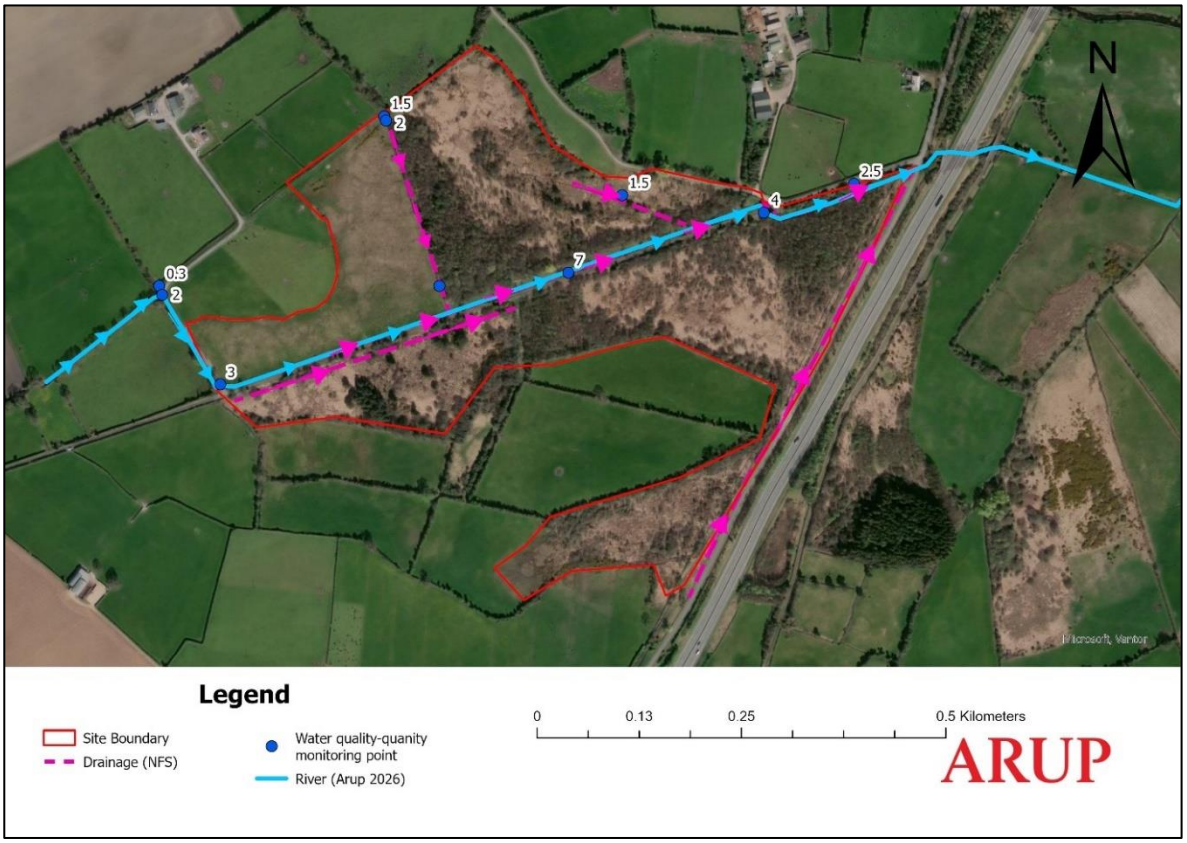


Figure 3-22: Drain widths (m) at Kilnaseer

3.2.2 Water Quality

Water quality monitoring shows spatial variation in nutrient concentrations across the site, with potential sources of enrichment particularly evident in areas adjacent to agricultural activity.

Two measurements exceeded the regulatory groundwater threshold of 8.5 mg/l NO_3-N (37.5 mg/l NO_3) set under the European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016 (S.I. No. 366 of 2016). Although there is no regulatory surface water threshold for nitrate, mean nitrate concentrations of greater than 1.8 mg/l NO_3-N (8 mg/l NO_3) may impact the ecological health of rivers (EPA, 2025b). Nitrate concentrations in the south-west flow inlet entering the site are high at 25.5 mg/l (NO_3-N) and at the outlet of the fen in the southern eastern drain of 25.2 mg/l (NO_3-N). The drain inflow in the centre of the fen shows much lower concentrations of 1 mg/l (NO_3-N) and 1.4 mg/l (NO_3-N).

Nitrate concentrations during the site surveys are shown in (Figure 3-23).

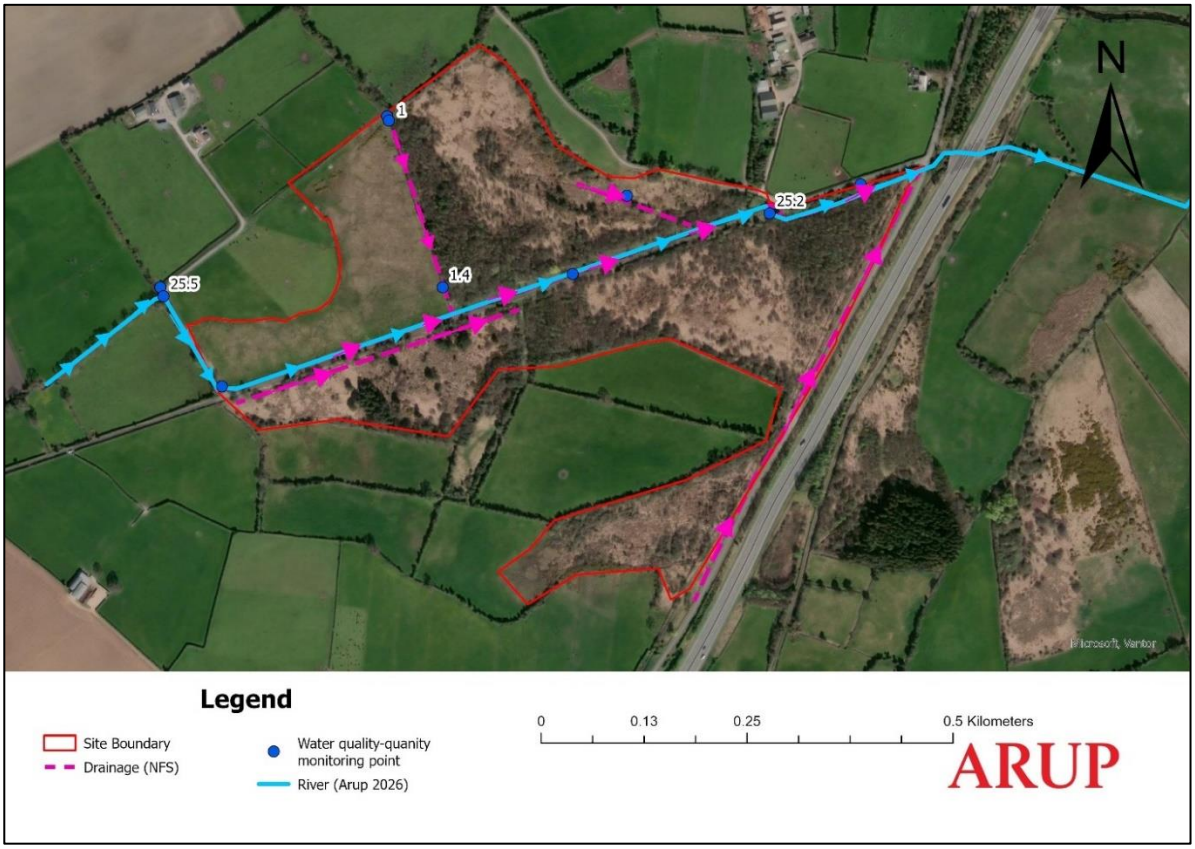


Figure 3-23: Nitrate (mg/l NO_3) at Kilnaseer

Phosphate concentrations (PO4) across the site vary, with all measurements exceeding the WFD good status environmental quality standard of 0.107 mg/l PO4 (0.035 mg/l PO4-P[8]) set

[8] S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009

under the European Union Environmental Objectives (Surface water) Regulations 2009) (S.I. No. 272 of 2009) Phosphate concentration across the site did not vary greatly with a range of 0.17-1.2 mg/l PO4 (Figure 3-24).

The value of 1.2 mg/l PO4 at the centre drain (ID 6) is considerably high phosphorus value, likely due to the agricultural activity on the left (west) of the drain. This spatial pattern also aligns with areas identified as being at risk in the EPA PIP maps for phosphorus (Figure 3-24).

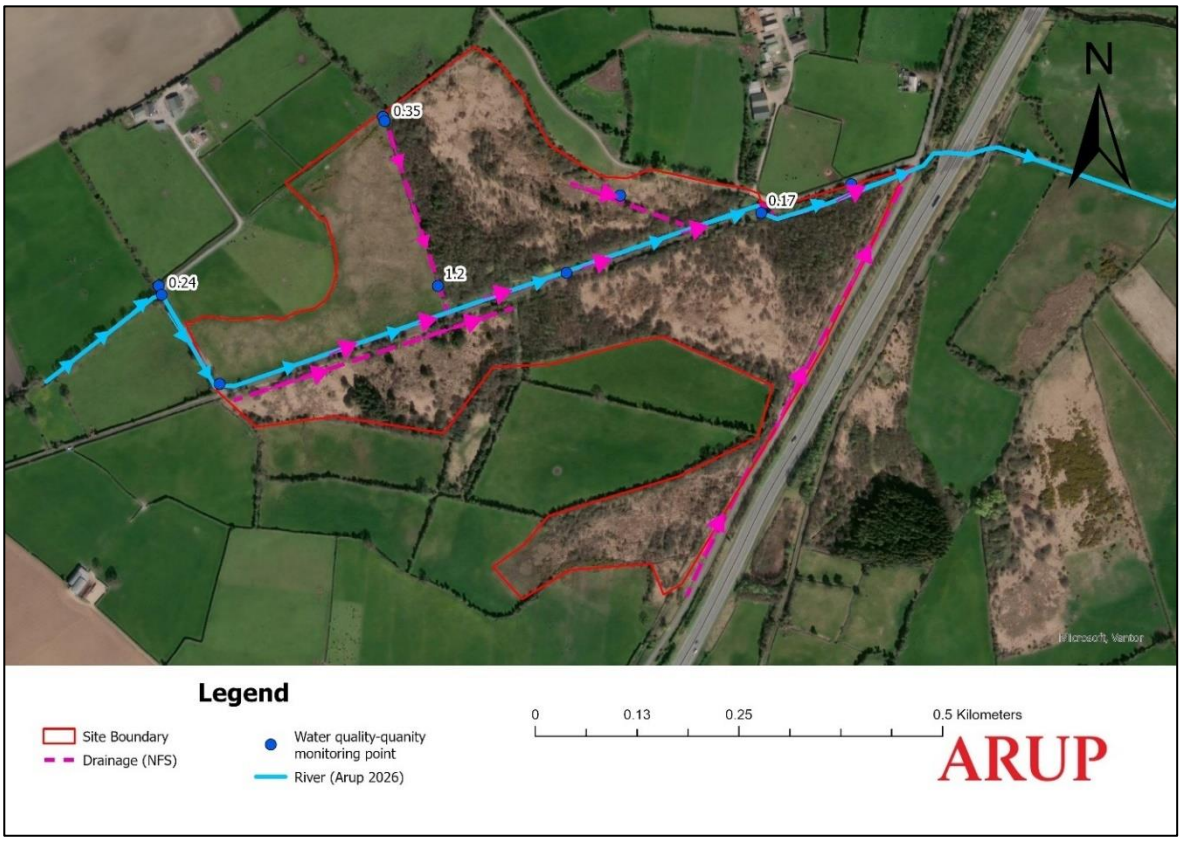


Figure 3-24: Phosphate (mg/l PO4)) at Kilnaseer

Electrical conductivity (EC) and pH were measured during field site visits. pH values ranged 7.83 in the south-west flow inlet entering the site and 7.722 at the outlet of the fen (ID 9) in the southern eastern drain. EC values ranged from 753 µS/cm at inflow and 772 µS/cm at the outflow.

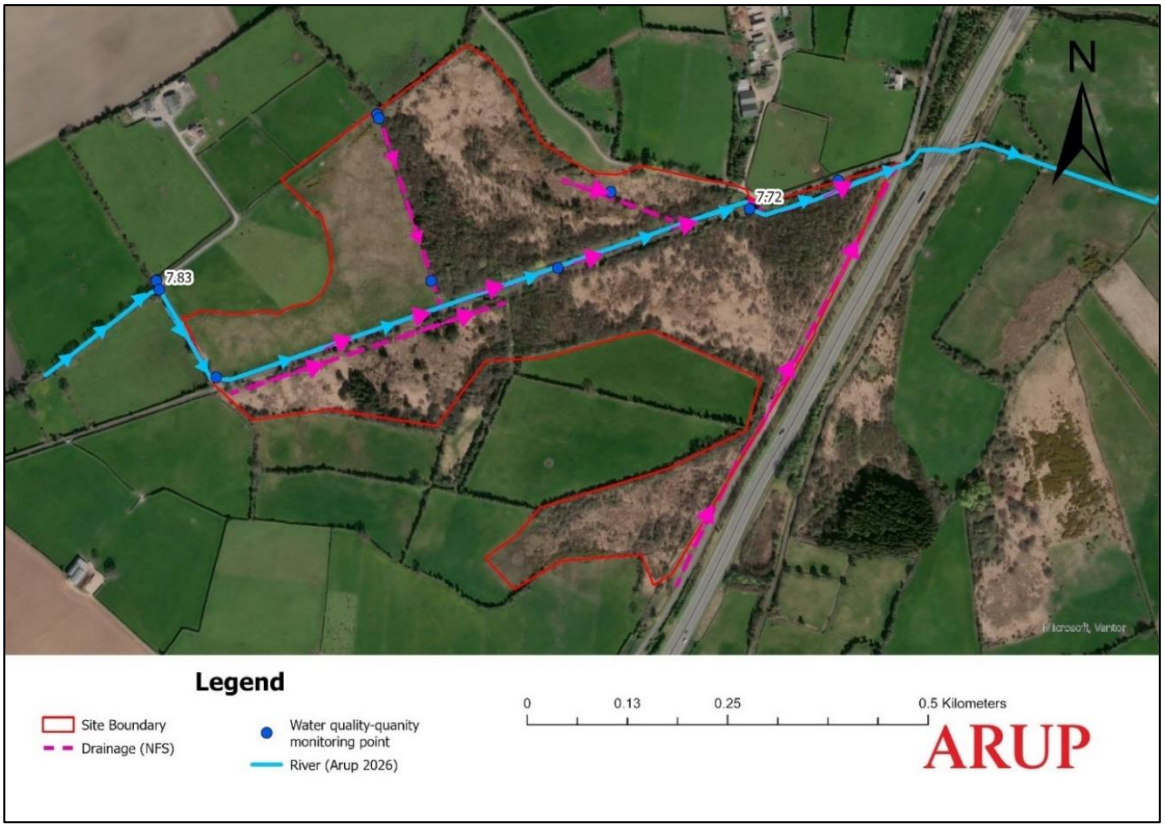


Figure 3-25: pH at Kilnaseer

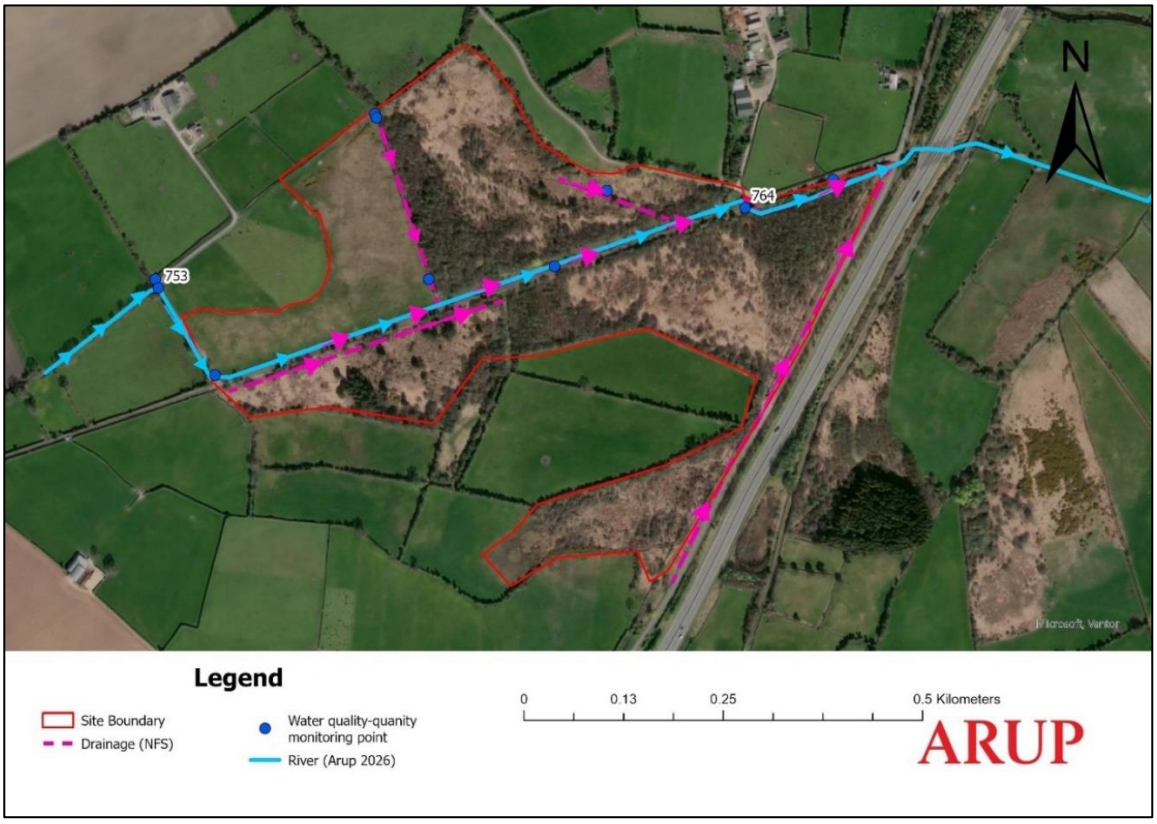


Figure 3-26: Electrical conductivity (EC) (µS/cm) at Kilnaseer

3.3 Conceptual Site Model

Kilnaseer occurs at an elevation of 79 mOD within a lower lying basin and is surrounded by hillslopes at 87 mOD to the north-east and south-west. In its natural condition the site would have been connected to the wider wetland system of the River Barrow and River Nore SAC. The historical and more recent modifications to the site have had significant effects on the fen hydrology and habitat health. This has constrained the site to the west, disconnected it from surrounding habitats and drained the central basin towards the M8 culvert and onwards to the downstream tributary of the Erkina River.

Although there were no springs or wells identified within the site boundaries by the NFS (Brophy, In Prep), field surveys to the east outside of the site boundary indicated a presence of Annex I quality 7220 Petrifying springs. Historically the River Barrow and River Nore SAC had springs identified and there is an upstream spring to the south, which was previously captured within a reservoir and directed towards a mill race. This indicates that there is likely groundwater connection within and around the wetland.

Kilnaseer was classed during the NFS (Brophy, In Prep) as mainly being WETMEC 8: Groundwater-Fed Bottoms with aquitard (Wheeler et al., 2009). The desk study and field survey results indicate that the bedrock is a karstified limestone (Ll aquifer) that provides a direct hydraulic connection to the fen.

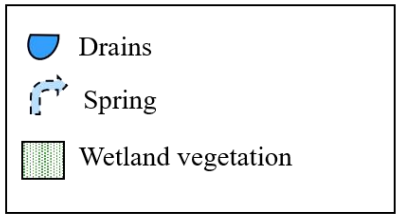
This suggests that the classification for Kilnaseer in its natural condition should be **WETMEC 9a: Groundwater-Fed Bottoms**, in connection to the wider wetland system. There is evidence of springs and tufa in the surrounding area representing WETMEC 16a: Groundwater flushed bottom. The surface water within the arterial drain is being fed by an upstream spring from the west.

Modifications to the natural condition of the site have meant that portions of wetland on either side of the local road are currently in the state of WETMEC 9b: Part-Drained Groundwater Bottom under the influence of historical and current drainage. As it is unlikely that the central drain can be altered due to the association to the local and upgraded road, the focus for restoration will be on local hydrology improvements within the site boundary.

The primary habitats across the site occur in the form of a mosaic of Annex quality 7140 Transition mire and 7230 Alkaline fens with small patches of 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* present within the 7230 Alkaline fens habitat in the northern area of the site.

Kilnaseer
County Laois
WFD catchment: Nore (ERKINA_050)
WETMEC 9b: Groundwater fed bottom

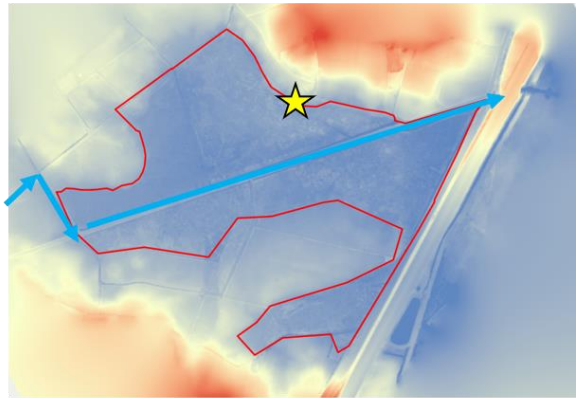
Water key:



Cross section:



Water input/output:



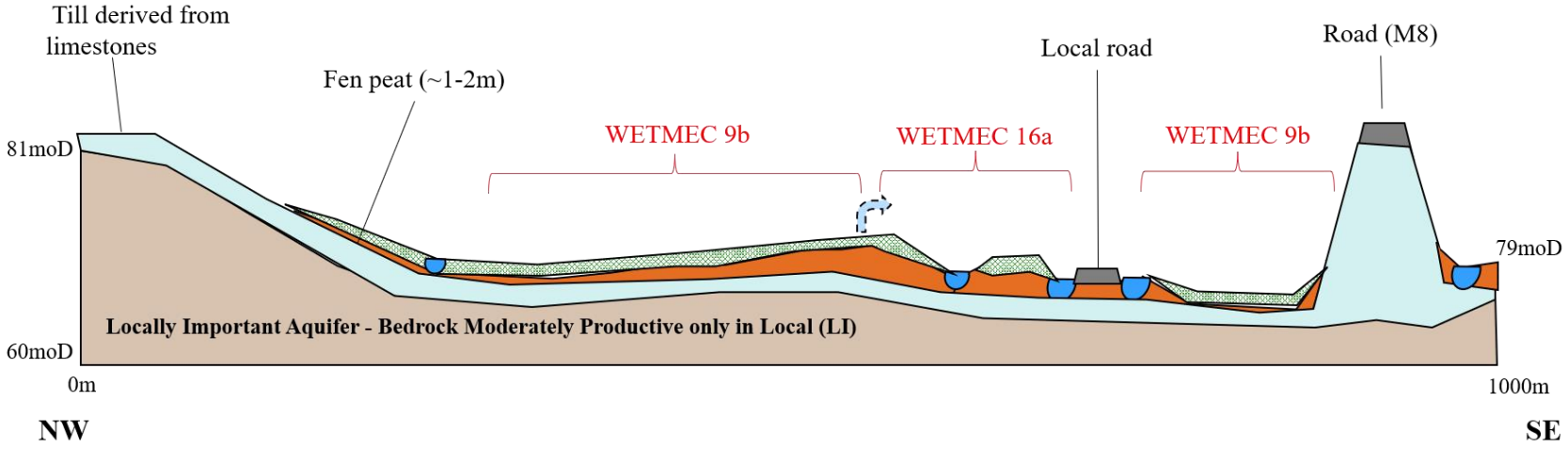


Figure 3-27: Conceptual Site Model for Kilnaseer

4 Ecology

4.1 Desk Study

A review of available desktop information on the ecological baseline for Kilnaseer and to inform the development of appropriate restoration measures. The following sources were reviewed:

- NPWS Article 17 habitats distribution datasets;
- National Fen Survey (Brophy et. al., in prep);
- NPWS Site Synopsis and Site-specific Conservation Objectives (SSCOs) for the River Barrow and River Nore Special Area of Conservation (SAC) (Site Code: 002162);
- Biodiversity Maps - National Biodiversity Data Centre (NBDC);
- World Imagery Wayback - ArcGIS;
- Plant Atlas 2020 website - Botanical Society of Britain & Ireland (BSBI);

The NFS was commissioned to develop and apply a standardised methodology for assessing the conservation status of fen habitats across Ireland. As part of this programme, Kilnaseer (Co. Laois) was surveyed in August 2022, with a focus on the identification, mapping and condition assessment of fen and wetland habitats meeting Annex I habitat criteria. Survey methods 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 NFS indicates that Kilnaseer comprises a mosaic of wetland and terrestrial habitats, including fen, wet woodland, wet grassland and areas of scrub. Artificial drainage features bisect the site, with a principal east–west drain aligned with the road crossing the site and additional drains entering from the northern area.

The NFS at Kilnaseer revealed identified a mosaic of Annex I quality 7140 Transition mire, 7210 Cladium fen, 7230 Alkaline fen and 91E0 Alluvial forests.

4.1.1.1 Annex Habitats

The following Annex I quality habitat was identified and mapped:

- **7140 Transition mire** (c. 0.49ha), occurring across the site and characterised by species including *Carex diandra, Carex nigra, Carex rostrata, Comarum palustre, Equisetum fluviatile, Mentha aquatica* and *Menyanthes trifoliata*. In parts of the site this habitat occurs within previously cut turf ditches.
- **7210 Cladium fen** (c. 0.8 ha), restricted to patches within areas of 7230 Alkaline fen in the northern part of the site with a very small area present in the south west of the site.
- **7230 Alkaline fen** (c. 3.56 ha), occurring in areas across the site and characterised by species including *Schoenus nigricans* and *Molinia caerulea*. The dominant area is within the north-east of the site.
- **91E0 Alluvial forests** (c. 3.31 ha), occurring primarily in the central part of the site, north of the local road network that bisects the site.

4.1.1.2 Non-Annex/Fossitt habitats

A range of non-Annex I habitats were also recorded and mapped using the Fossitt (2000) classification. These habitats are summarised in Table 4-1.

Table 4-1: Non-Annex I habitats recorded at Kilnaseer

Habitat Type	Location	Notes
FW4 – Drainage ditches	Bisecting the centre of the site on an east–west axis, with additional drains entering from the north	Main drains run adjacent to the road that bisects the site
GS4 – Wet grassland	Western half of the site	Managed and used for agricultural activities
FS1 – Reed swamp	Along the eastern side of the central road and drains	Occurs within and adjacent to central drainage features
FS2 – Tall-herb swamp	Along the western side of the central road and drains	Occurs within and adjacent to central drainage features
PB1 – Raised bog	Central part of the site, north of the road	Occurs adjacent to 91E0 and WN6 habitats
WS1 - Scrub	South-east of the site	Encroaching into adjacent Alkaline fen
WN6 – Wet willow-alder-ash woodland	Central part of the site north of the road	Overlaps with 91E0 and PB1 habitats

4.1.2 Species

The following sections summarise species recorded within Kilnaseer and within the wider zone of influence of the site. Records include species listed under relevant legislation and conservation frameworks, including the EU Habitats and Birds Directives, the Wildlife Acts and Irish Red Lists. Species records are limited to those from the past ten years, reflecting the most plausible timeframe for continued presence and ecological relevance.

4.1.2.1 Species Within the Site

The species within the Table 4-2 below were identified using the NBDC records, NFS documentation and from the ecological walkover conducted in 2026.

Table 4-2: Species records within Kilnaseer

Common Name	Latin name	Description	Most recent record
Black bog-rush	*Schoenus nigricans*	A characteristic species of base-rich and calcareous fens and a key indicator of Annex I habitat 7230 Alkaline fen.	2022
Purple moor-grass	*Molinia caerulea*	A widespread grass of wetland habitats; occurs within fen and wet grassland mosaics and may increase under altered hydrological or nutrient conditions.	2022
Marsh helleborine	*Epipactis palustris*	A fen and wet grassland orchid associated with calcareous wetland soils; of conservation interest due to national declines.	2022
Common sedge	*Carex nigra*	A widespread sedge of wet habitats; recorded in fens, flushes and wet grasslands in association with other fen species.	2022
Devil's bit scabious	*Succisa pratensis*	A characteristic species of wet grassland and fen margins, frequently occurring within species-rich fen mosaics.	2022
Small Eggar	*Eriogaster lanestris*	An Irish Near Threatened moth species; presence reflects the availability of suitable larval foodplants within the wider wetland landscape.	2021
Common frog	*Rana temporaria*	A protected amphibian species listed under the Wildlife Acts; associated with wetland habitats and utilising fen environments for foraging and breeding.	2022
Water rail	*Rallus aquaticus*	A wetland bird species protected under the Birds Directive; recorded in dense vegetation within marshy and fen habitats.	2020

4.1.2.2 Species within the Zone of Influence

Species listed in Table 4-3 were recorded within a 2km zone of influence around Kilnaseer and reflect the wider wetland, riparian and agricultural landscape within which the site is located. These records provide context for potential functional connectivity and ecological linkages beyond the site boundary.

Table 4-3: Species records within the Zone of Influence of Kilnaseer

Legislative Protection	Common Name	Latin Name
EU Birds Directive	Black-headed gull	*Chroicocephalis ridibundus*
EU Birds Directive	Coot	*Fulica atra*
Irish Wildlife Act	Cormorant	*Phalacrocorax carbo*
EU Birds Directive	Curlew	*Numenius arquata*
EU Birds Directive	Dunlin	*Calidris alpina*
No legislative protection	Fieldfare	*Turdus pilaris*
Irish Wildlife Act	Goldcrest	*Regulus regulus*
EU Birds Directive	Golden Plover	*Pluvialis apricaria*
EU Birds Directive	Great Black-backed Gull	*Larus mirinus*
Irish Wildlife Act	Great Spotted Woodpecker	*Dendrocopos major*
EU Birds Directive	Grey Heron	*Ardea cinerea*
No legislative protection	Grey Wagtail	*Motacilla cinerea*
EU Birds Directive	Greylag Goose	*Anser anser*
Irish Wildlife Act	House Martin	*Delichon urbicum*
No legislative protection	House Sparrow	*Passer domesticus*
Irish Wildlife Act	Kestrel	*Falco tinnunculus*
EU Birds Directive	Kingfisher	*Alcedo atthis*
EU Birds Directive	Lapwing	*Vanellus vanellus*
EU Birds Directive	Lesser Black-backed gull	*Larus fuscus*
EU Birds Directive	Little Egret	*Egretta garzetta*
EU Birds Directive	Mallard	*Anas platyrhynchos*
Irish Wildlife Act	Meadow Pipit	*Anthus pratensis*
Irish Wildlife Act	Mistle Thrush	*Turdus viscivorus*
No legislative protection	Moorhen	*Gallinula chloropus*
Irish Wildlife Act	Mute Swan	*Cygnus olor*
EU Birds Directive	Peregrine	*Falco peregrinus*
Irish Wildlife Act	Redwing	*Turdus iliacus*
Irish Wildlife Act	Robin	*Erithacus rubecula*
Irish Wildlife Act	Rock Dove	*Columba livia*
EU Birds Directive	Ruff	*Calidris pugnax*
EU Birds Directive	Shelduck	*Tadorna tadorna*
Irish Wildlife Act	Snipe	*Gallinago gallinago*
Irish Wildlife Act	Sparrowhawk	*Accipiter nisus*
No legislative protection	Starling	*Sturnus vulgaris*
No legislative protection	Stonechat	*Saxicola rubicola*
No legislative protection	Swallow	*Hirundo rustica*
EU Birds Directive	Teal	*Anas crecca*
No legislative protection	Water Rail	*Rallus aquaticus*
No legislative protection	Wheatear	*Oenanthe oenanthe*
EU Birds Directive	Whooper Swan	*Cygnus cygnus*
No legislative protection	Willow Warbler	*Phylloscopus trochilus*
No legislative protection	Yellowhammer	*Emberiza citrinella*
EU Habitats Directive	Marsh Fritillary	*Euphydryas aurinia*

Legislative Protection	Common Name	Latin Name
No legislative protection	Small Heath	*Ponympha pamphilus*
No legislative protection	Dull-vented Sharp-tailed Bee	*Coelioxys elongata*
No legislative protection	Narrow-bordered Five-spot Burnet	*Zygaena lonicerae*
No legislative protection	Small Eggar	*Eriogaster lanestris*
EU Habitats Directive	Desmoulin's Whorl Snail	*Vertigo moulinsiana*
EU Habitats Directive	Pine Marten	*Martes martes*

4.2 Field Survey

Following a comprehensive review of available desktop data, a targeted follow-up ecological survey was undertaken on the site in April 2026. 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.

Two survey forms were created to collect data relevant to:

- Monitoring data; and
- Pressures and threats.

4.2.1 Monitoring Points

To inform the restoration plan for Kilnaseer, 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 five pre-identified monitoring points (Monitoring Points 1-5), 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. A map of survey points is provided in Appendix B.

These monitoring points now serve a dual purpose:

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

At each monitoring point, surveys focused on:

- 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 several fen habitat types, notably the Annex quality habitats of:

- 7210 Cladium fen, recorded at Monitoring Points 3 and 4
- 7220 Petrifying springs with tufa formation at Monitoring Point 2.

The presence of calcifying conditions and tufa formation at Monitoring Point 2 is indicative of groundwater-fed conditions and supports the identification of Annex I quality 7220 Petrifying springs. This record is considered valid based on field observations; however, given the limited spatial extent and targeted survey approach, its distribution within the site may be localised. The monitoring points did not record the 7230 Alkaline fen habitat or 7140 Transition mire habitats during the 2026 ecological walkover.

4.2.2 Pressure & Threats

This section outlines the historical and current pressures affecting fen habitats at Kilnaseer, with particular emphasis on the Annex I habitats 7140 Transition mire, 7210 Cladium fen and 7230 Alkaline fen. Pressure and threat data were recorded at locations that spatially overlap with Monitoring Points 1 and 2, ensuring direct linkage between recorded pressures and monitored habitat condition. Pressures identified during the NFS and subsequent walkover surveys are described below.

4.2.2.1 7140 Transition mire

Historical Pressures

The NFS determined that the structure and functions of Transition mire habitat at Kilnaseer was Unfavourable – Bad, with negative pressures primarily relating to drainage and changes in land management resulting in problematic native species (scrub encroachment and rank vegetation).

- **Drainage**: Artificial drains bisect the site on an east–west axis on both sides of the road, with additional drains entering from the northern part of the site. These features lower water tables within transition mire habitat and facilitate drying of peat surfaces.
- **Grazing abandonment**: The cessation of traditional pastoral systems has resulted in insufficient grazing pressure, facilitating the development of rank vegetation and reducing structural diversity within the habitat. This has led to a dominance by rank and tall vegetation.
- **Scrub encroachment**: Ongoing natural succession, facilitated by drainage, has resulted in encroachment by scrub species, leading to shifts in vegetation composition and a reduction in characteristic transition mire species.

Current Observations

No areas of Annex I habitat 7140 Transition mire were recorded at the Monitoring Points during the 2026 survey. The habitat was previously recorded during the 2022 NFS, when approximately 0.49 ha of 7140 Transition mire was mapped at Kilnaseer and its structure and functions were assessed as Unfavourable–Bad. The non-detection of 7140 Transition mire at the monitoring points therefore indicates a potential local contraction, degradation or reduced detectability of this habitat within the areas targeted for monitoring.

This finding should not be interpreted as confirmed complete loss of 7140 Transition mire from the wider Kilnaseer site, as the 2026 monitoring approach was targeted and spatially limited. The monitoring points were selected to inform restoration planning and do not constitute a full repeat habitat mapping exercise. Differences between the 2022 NFS and the 2026 walkover, including survey extent, monitoring point location, hydrological conditions and seasonal timing, may have influenced whether small or degraded areas of 7140 Transition mire were detected.

However, the absence of 7140 Transition mire from the monitored locations is ecologically significant. Where previously recorded 7140 Transition mire is subject to drainage-induced drying, reduced groundwater and surface-water connectivity, scrub encroachment and development of rank vegetation, the habitat can shift away from open, wet transition mire communities towards drier fen, reed, scrub or other degraded wetland vegetation. This would represent a deterioration in habitat structure and function and may indicate that the habitat is becoming increasingly localised, fragmented or difficult to distinguish from surrounding degraded fen vegetation..

4.2.2.2 7210 Cladium Fen

Historical Pressures

The NFS determined that the structure and functions of the Annex quality Cladium fen habitat at Kilnaseer was Favourable, though negative pressures relating to drainage and problematic native species (scrub encroachment and rank vegetation) exist across the site which continue to pressure this habitat.

- **Drainage**: Drainage features crossing and entering the site influence surrounding fen habitats and, in some locations, extend into areas supporting Cladium fen. While core Cladium stands remain relatively robust, localised drying near drainage features presents a pressure if unmanaged
- **Scrub encroachment**: Reduced grazing pressure and hydrological alteration have facilitated early stages of scrub development along the margins of Cladium fen patches.

Current Observations

Walkover surveys identified the following within areas of 7210 Cladium fen:

- **Drainage:** Generally favourable hydrological conditions within core Cladium patches, although localised drying was observed near drainage features;
- **Scrub encroachment:** Early signs of scrub encroachment along habitat margins, indicating a need for monitoring and potential targeted intervention.

4.2.2.3 7230 Alkaline fen

Historical Pressures

The NFS assessed the structure and functions of 7230 Alkaline fen at Kilnaseer as Unfavourable – Bad, with negative pressures primarily relating to drainage and problematic native species.

- **Drainage:** Historical drainage features, including drains aligned along and crossing the site, have altered natural hydrological regimes within alkaline fen habitats. The influence of these features is spatially variable, with the strongest effects observed in areas closest to drains.
- **Grazing abandonment:** The cessation of grazing has resulted in insufficient biomass removal, contributing to the development of rank grass-dominated swards and reduced habitat heterogeneity.
- **Scrub encroachment**: Drainage-related drying and reduced grazing pressure have facilitated scrub development, particularly along road margins and habitat edges, leading to shading and changes in evapotranspiration dynamics

Current Observations

Recent walkover surveys identified the following within areas of 7230 Alkaline fen:

- **Scrub encroachment:** Localised scrub encroachment, particularly along road margins and habitat edges, exerting pressure on fen vegetation;
- **Grazing abandonment:** Areas of rank grass dominance indicative of undergrazing, particularly in northern and southern sections of the site.

4.2.3 Additional Observations

Additional observations were recorded during site visits and are summarised below to provide further context for restoration planning.

- Towards the centre of the site, ground conditions become increasingly wet, with extensive areas of alkaline fen observed, including small patches of Cladium fen.
- Land adjacent to the fen is largely agricultural, with varying grazing intensity and evidence of land modification along site boundaries.

- Sections of forestry occur along parts of the road that bisects the site, dominated by alder (*Alnus glutinosa)*, birch (*Betula pubescens)* and oak (*Quercus* spp.), contributing to scrub pressure along habitat margins.
- An area to the east of the site was identified as a potential marsh or fen; however, this field is currently intensively managed for agriculture and shows signs of agricultural intensification through mowing and grazing.
- While water levels were generally favourable within core fen areas, localised drier patches were observed, suggesting potential influence from drainage features that may be suitable targets for hydrological intervention.

These observations informed the identification of potential restoration measures, including:

- Drainage management and drain blocking where hydrologically appropriate;
- Exploration of low-intensity grazing regimes to address rank vegetation;
- Monitoring and targeted removal of scrub where it is demonstrated to negatively affect fen habitats.

4.3 Site Conservation Priority Matrix for Kilnaseer Site

The restoration actions proposed (Table 4-4) for the Annex quality habitats of Kilnaseer are expected to deliver broader ecological benefits beyond their target habitat types. If these measures are successfully implemented and sustained, they may positively influence associated features such as European priority species, nationally important species, and locally significant habitats and species. In such cases, the additional restoration interventions outlined for these other features may become unnecessary or only partially required. However, to validate and understand the extent of these mutual benefits, ongoing post-restoration monitoring will be essential. This will ensure that improvements are not limited to Annex quality habitats alone but extend to the wider ecological network within and around the site.

Table 4-4: Site Conservation Priority Matrix for Kilnaseer

Level	Feature Type	Feature Name	Extent/ Population	Pressure/threat	Restoration Measure on-site	Restoration Measure off-site
1	SAC Habitat	91E0 Alluvial forests	3.31ha	Potential indirect effects from adjacent drainage; scrub expansion at habitat margins	Vegetation condition monitoring; targeted edge scrub management where encroachment threatens adjacent Annex I quality fen habitats	Buffer zone management (scrub control, nutrient input management, drainage management)
	Annex quality habitat (non-QI)	7140 Transition mire	0.49ha	Historical drainage; abandonment of grazing; scrub encroachment; development of rank vegetation	Targeted drain management and hydrological monitoring; reintroduction of low-intensity grazing; vegetation monitoring; targeted scrub removal where negatively affecting habitat condition	
		7210 Cladium fen	0.8ha	Localised drainage influence; early-stage scrub encroachment	Vegetation and hydrological monitoring; targeted scrub removal at habitat margins where required; drain management where hydrologically appropriate	
		7230 Alkaline fen	3.56ha	Grazing abandonment; historical drainage; scrub encroachment	Targeted drain blocking and hydrological monitoring; reintroduction of low-intensity conservation grazing; vegetation monitoring; targeted scrub removal where impacting fen structure and function	
1	SAC Species	Desmoulin's whorl snail *Vertigo moulinsiana*	Data deficient	Drainage; scrub encroachment	Habitat condition and hydrological monitoring; targeted scrub management where it affects suitable microhabitats	Buffer zone management to maintain suitable hydrological and vegetation conditions

Level	Feature Type	Feature Name	Extent/ Population	Pressure/threat	Restoration Measure on-site	Restoration Measure off-site
2	NHA Habitat	N/A	N/A	N/A	N/A	N/A
3	European priority species	N/A	N/A	N/A	N/A	N/A
4	Nationally important species	See Tables 4-2 and 4-3	See Tables 4-2 and 4-3	Habitat degradation via drainage and scrub encroachment	Indirect benefit through fen habitat restoration; vegetation and hydrological monitoring; targeted scrub management where required	Buffer zone management (Management of scrub encroachment, nutrient input and drainage)
5	Habitats and species of local interest	GS4 – Wet grassland FS1 – Reed swamp FS2 – Tall-herb swamp PB1 – Raised bog WN6 – Wet willow-alder-ash woodland	See Appendix B	Drainage Scrub encroachment	Vegetation monitoring Scrub removal (where necessary) Drain blocking and hydrological monitoring	Buffer zone management (Management of scrub encroachment, nutrient input and drainage)

4.4 Impact Assessment Notes

The restoration actions proposed for Kilnaseer intended to improve the ecological condition of sensitive wetland and fen habitats, with a particular focus on Annex I quality habitats[2] of 7140 Transition mire, 7210 Cladium fen and 7230 Alkaline fen, as well as the SAC QI habitat 91E0 Alluvial forests.

The proposed restoration measures are directly connected to, and necessary for, the management of the SAC. In particular, they are designed to support favourable conservation status at both site and catchment scale by improving hydrological conditions, vegetation structure and habitat resilience thereby contributing to the maintenance of suitable habitat conditions for the SAC qualifying interests relevant to Kilnaseer, namely 91E0 Alluvial forests and *Vertigo moulinsiana*. Potential direct and indirect impacts have been considered to ensure compliance with Article 6(3).

Potential Impacts

- **Habitat loss** – low risk - Restoration actions (i.e. scrub removal) are designed to enhance existing habitats rather than result in habitat loss. Minor, localised loss of degraded vegetation may occur during scrub clearance; however, this is not expected to result in a net loss of Annex quality habitat or SAC QI habitat.

- **Habitat degradation –** moderate risk - Localised habitat degradation could occur if restoration measures are poorly implemented or not followed by appropriate monitoring and adaptive management. For example, scrub removal without follow-up could lead to soil disturbance, erosion or colonisation by undesirable species. Similarly, repeated access for monitoring, if not carefully managed, could result in trampling or disturbance. These risks will be managed through appropriate implementation methods, timing of works and ongoing ecological oversight.

- **Species disturbance** – very low risk – where required works will be appropriately timed to minimise risk of disturbance, with supervision by an Ecological Clerk of Works where necessary.

- **Accidental pollution release** – very low risk - No chemical inputs are proposed. However, machinery use (if any) could pose a risk of fuel/oil leaks. This is mitigated by avoiding machinery in sensitive areas and using hand tools where possible.

- **Introduction and/or spread of invasive non-native species** – moderate risk - Restoration activities (e.g. soil disturbance, water movement) could facilitate dispersal of invasive species. Monitoring and biosecurity protocols will be embedded into the site plan to avoid such risks

4.5 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 4-5 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 4-5: Good Practice Recommendations

Receptor	Measure
Ground nesting birds	No vegetation clearance or activity which might contravene Section 40 of the wildlife act (consolidated) should be undertaken.
Invasive Alien Species	All vehicles should undergo stream cleaning before site entry. Identified buffers on IAS should be avoided during site preparation and restoration implementation. Consideration should be given to confirmatory survey to identify the latest *Rhododendron* infestation extent along with ecological oversight regarding works proximal to larger infestations.
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 Kilnaseer 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 NFS 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 then informed the overall conservation status assessment was applied based.

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

Table 5-1: Conservation Status Assessment of Kilnaseer (NFS)

OVERALL CONSERVATION STATUS ASSESSMENT				
Annex I habitat	**Area**	**Structure & functions**	**Future prospects**	**Overall Conservation Status**
7140	Not assessed	Unfavourable-Bad	Not assessed	Not assessed
7210	Not assessed	Favourable	Not assessed	Not assessed
7230	Not assessed	Unfavourable-Bad	Not assessed	Not assessed

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 the ecology.

As part of the ecology monitoring surveys, pressures and threats associated with the monitoring points 1 and 2 were recorded. A summary is provided within Section 5.2.

5.2 Key Pressures

The NFS and subsequent walkover observations identify three primary pressures at Kilnaseer that are relevant to the condition and restoration of Annex I quality fen habitats: historical drainage, scrub encroachment and abandonment of traditional grazing regimes resulting in undergrazing and the development of rank vegetation. Where relevant, potential pressures relating to nutrient inputs are noted based on adjacent land use; however, the NFS draft site report records no evidence observed for signs of nutrient enrichment at the time of survey.

The apparent absence of 7140 Transition mire habitat at monitored locations suggests a potential shift in ecological condition since the 2022 NFS baseline. Drainage-induced lowering of the water table can reduce the persistence of quaking and transitional mire communities, leading to replacement by drier fen or scrub-dominated vegetation. Restoration measures aimed solely at achieving WETMEC 9a conditions may not be sufficient to restore 7140 habitat where peat structure and hydrological regime have been significantly altered. Recovery of this habitat may require sustained rewetting, reduction in drainage efficiency, and restoration of localised groundwater–surface water interactions.

5.2.1 Flora and Fauna Pressures

The following pressures are listed in order of their relative intensity and impact on ecological receptors at Kilnaseer. These pressures were identified through review of NFS outputs and validated during field surveys undertaken as part of this FRP.

- **Drainage**

  Evident through historical and actively functioning drains associated with the road corridor and extending northwards across the site. Drainage alters local hydrology, lowering water tables and facilitating habitat drying, which in turn promotes scrub encroachment and changes in fen vegetation structure (see Figure 5-1).

- **Abandonment of traditional grazing regimes**

  Large areas of fen are currently ungrazed or no longer subject to the low-intensity grazing regimes that historically helped maintain open fen vegetation. In fen habitats, appropriately managed conservation grazing can play an important ecological role by removing accumulated biomass, limiting the dominance of competitive grasses and tall herbs, suppressing scrub establishment, and maintaining structural diversity. At Kilnaseer, the reduction or cessation of this management has contributed to the development of rank vegetation and litter accumulation in some areas, creating conditions that favour competitive species and reduce the availability of open microhabitats required by characteristic fen flora. This differs from intensive agricultural grazing, which can adversely affect fen habitats through poaching, nutrient enrichment and vegetation damage. The objective is therefore not increased agricultural grazing, but the reintroduction of carefully managed, low-intensity conservation grazing where appropriate to support favourable fen habitat condition (see Figure 5-1).

- **Scrub encroachment**

  Localised but increasing encroachment by native scrub species, particularly willow (*Salix spp*.) and alder, is evident within fen habitats. Scrub establishment is most pronounced along drainage-influenced margins and habitat edges, where altered hydrological conditions and reduced grazing pressure promote succession. Scrub encroachment contributes to shading, increased evapotranspiration, fragmentation of open fen habitat, and loss of characteristic fen structure (see Figure 5-1).

Historical pressures, which were not evidenced during site walkover surveys but remain relevant to the ecological functioning of the site, are outlined below. The absence of observed evidence does not preclude their potential influence.

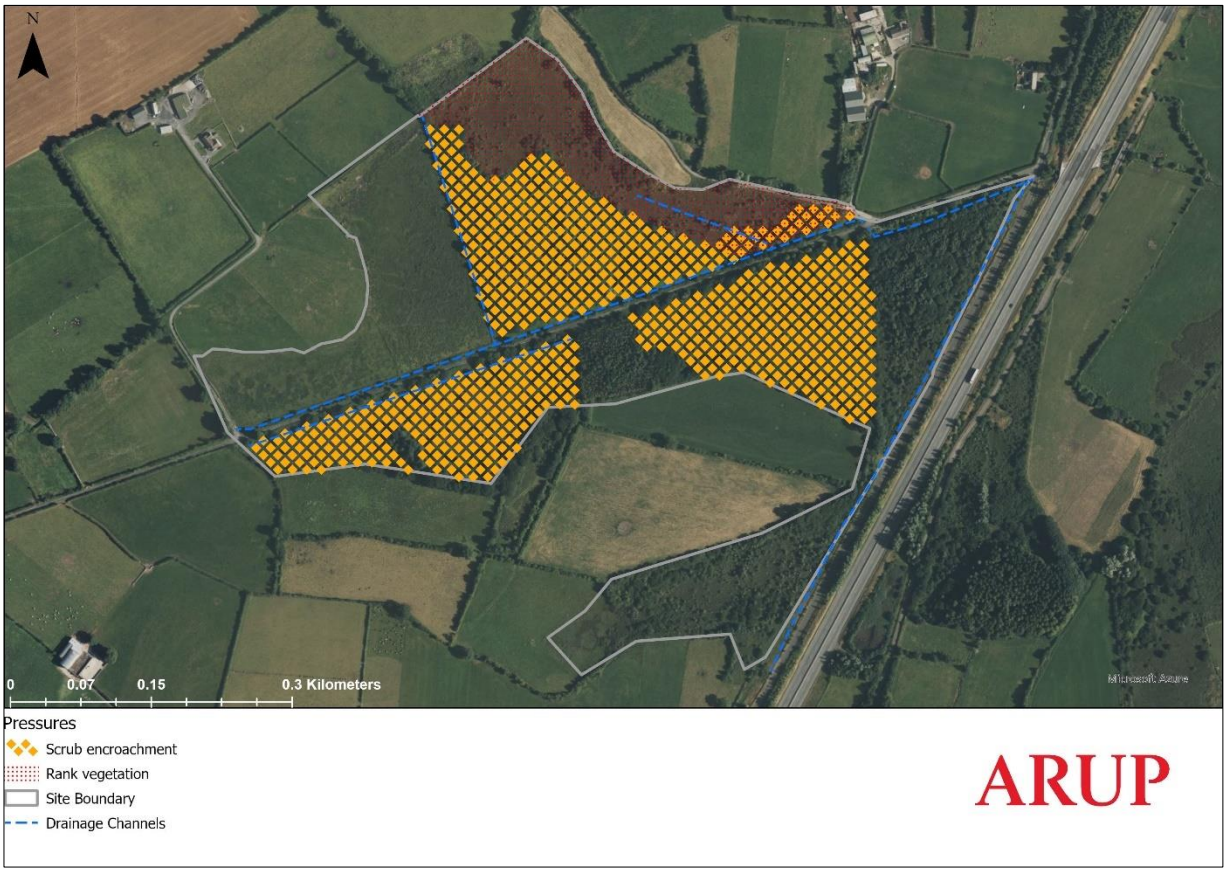


Figure 5-1: Flora & Fauna Pressures mapped within Kilnaseer

5.2.2 Fen Hydrology Pressures

Drainage has been identified as a key pressure. There is an arterial drain that traverses the fen from south-west to north-east. This drain is up to 3m deep and 7m wide and is likely exerting a significant control on the water levels in the fen. There are smaller drains off the fen that connect to the drain and create local controls on water levels. One drain located within the habitat to the east shows localised impacts and has been highlighted as pressures requiring targeted management.

The identified 7220 Petrifying springs habitat can be particularly sensitive to changes in groundwater discharge, water chemistry, and nutrient status. Drainage and alteration of flow paths may reduce groundwater upwelling, while elevated nutrient concentrations can disrupt tufa-forming processes and associated bryophyte communities.

5.2.3 Fen Nutrient Pressures

Diffuse pollution from agricultural activities represents a potential nutrient pressure on the fen habitats at Kilnaseer. The surrounding land use is predominantly agricultural, and nutrient transport pathways identified through EPA PIP mapping indicate areas of elevated risk for phosphorus and nitrate delivery to the site's drainage network. Water quality monitoring undertaken as part of this FRP recorded elevated nitrate and phosphate concentrations within the site drains, particularly within the main arterial channel that traverses the site. Nitrate concentrations exceeded groundwater threshold values at both the south-west inflow and the site outflow locations, while phosphate concentrations exceeded WFD good status thresholds at all monitored locations. The highest phosphate concentration was recorded within the central drain, suggesting influence from adjacent agricultural land use.

No evidence of nutrient enrichment was identified as a pressure during the NFS, and ecological walkover surveys undertaken as part of this FRP found limited evidence that elevated nutrient concentrations within the drainage network have, to date, resulted in widespread nutrient enrichment of the fen vegetation itself. However, the recorded water quality data indicate that the site remains vulnerable to nutrient inputs from the wider catchment. Continued delivery of elevated nutrient loads has the potential to promote competitive grasses, reeds and tall-herb species, alter vegetation composition, and reduce the ecological quality of Annex I fen habitats over the long term.

Although nutrient enrichment is not considered the primary driver of habitat degradation at Kilnaseer, it represents a secondary pressure that may interact with hydrological modification and undergrazing to influence habitat condition. Consequently, nutrient management measures, catchment engagement and ongoing water quality monitoring have been incorporated into the FRP to reduce nutrient inputs and track future changes in water quality and habitat response

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 fen. In some areas it must be recognised that restoration to fen habitat 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. The restoration measures proposed are outlined in Section 6.2**Error! Reference source not found.** to Section 6.3, with detailed mapping of proposed measures illustrated in the maps provided in Appendix B.

6.2 Hydrology Measures

The hydrological restoration objective for Kilnaseer is to improve parts of the site from WETMEC 9b: Part-Drained Groundwater-Fed Bottom to **WETMEC 9a: Wet Groundwater-Fed Bottom**. Although full achievement of WETMEC 9a will require blocking the arterial drain, the objective for the site will be to focus on smaller drains in support of local water level improvement for 7230 Alkaline fens to the south which is fed by WETMEC 16a: Groundwater flushed bottom (i.e. tufa springs)

6.2.1 On-site Hydrology Measures

Small internal drain blocking to East

Protection of groundwater discharge zones associated with 7220 Petrifying springs is required. This includes avoidance of drainage interception in the vicinity of Monitoring Point 2 and maintenance of consistent groundwater levels to sustain tufa formation processes.

The small drains to the East (Figure 6-1) discharge directly into the main central drain that runs through the site. According to the CSM the site is underlain with Aghmacart Formation limestone and 1-2m of fen peat. The narrowest area of the ditch will be chosen to provide firmer footing and to use less material. The smaller drain will be blocked at staggering intervals to ensure maximum peat wetting (NatureScot, 2019). At the connection point with the arterial drain timber or plastic piling will be used to reduce the connection to the main drain.

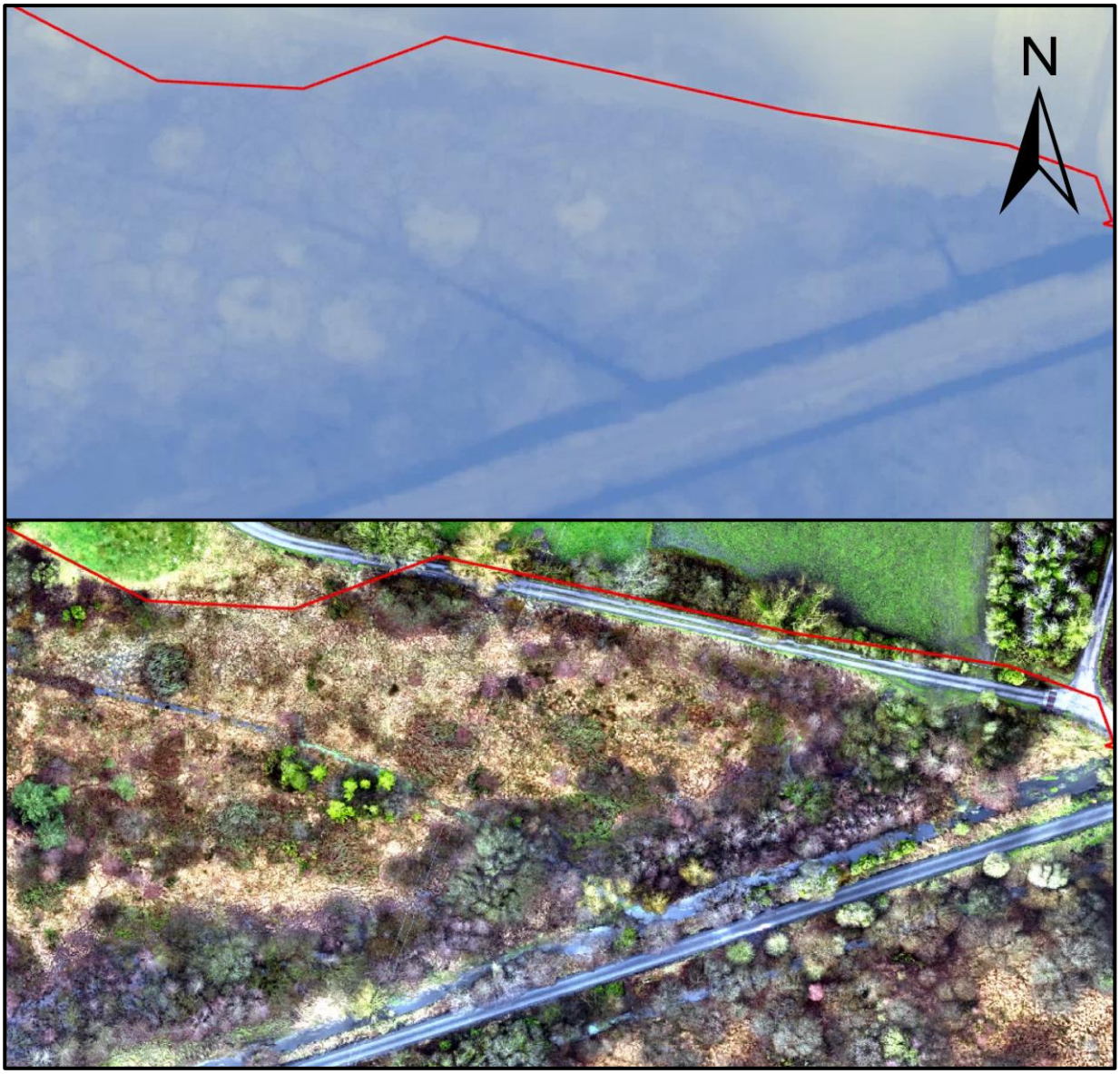


Figure 6-1: Small drains to the Northeast to be blocked, DTM and Ortho imagery

Equipment

On-site Fen Hydrology Measures In accordance with NatureScot Peatland Action guidance, peat dams will be constructed using small, low ground pressure excavators where ground conditions allow, to minimise disturbance and compaction of the peat surface. Excavators will be appropriately sized for access constraints and peat bearing capacity and may be used in conjunction with bog mats where required to reduce surface damage and improve machine stability.

Where access is constrained or machinery use would risk damage to sensitive vegetation or unstable peat, hand tools i.e. spades, may be used to construct or refine dams at selected locations. The excavator will be used to profile dam crests and adjacent ditch edges to avoid creating deep pools and to ensure controlled overtopping during high flows, in line with Peatland Action best practice (NatureScot, 2019).

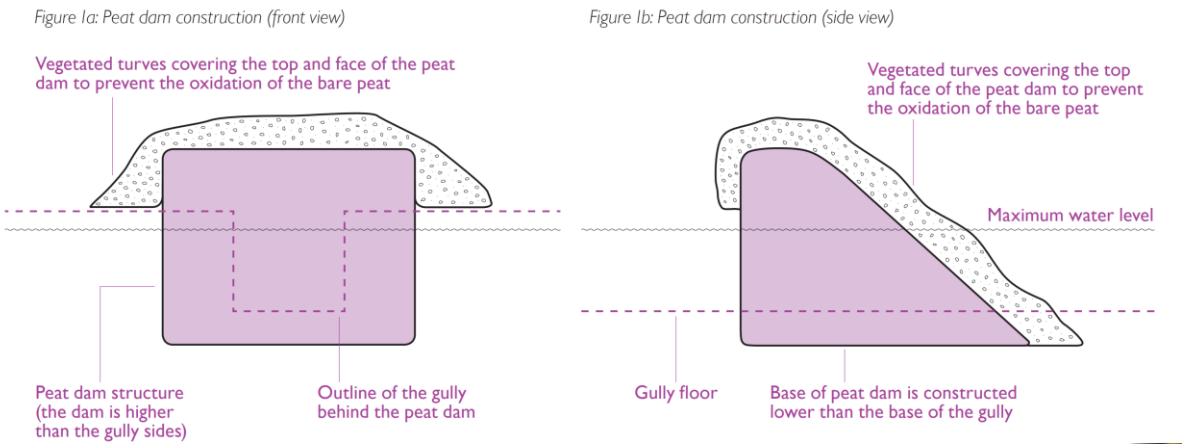


Figure 6-2: Peat dam cross sections (Moors for the Future Partnership, 2019).

Maintenance

An initial check should be undertaken approximately one month after installation to confirm the peat dams are functioning as intended (i.e. water is being held back) and to identify any early defects requiring repair. Checks should include confirmation that water is not bypassing around the sides or leaking underneath the dam, and that there are no major leaks or evidence of erosion/scour at the overflow point. Ongoing maintenance checks should continue on a seasonal basis, with particular attention to ensuring the overflow is not blocked by floating material and that dams continue to hold water effectively. Any defects identified should be repaired promptly to maintain hydrological performance and prevent progressive failure.

Monitoring progress

Monitoring will assess changes to the site water regime and habitat condition following installation of peat dams. Annual groundwater and surface water level monitoring will be undertaken using a network of piezometers and standpipes at key locations to track changes in water levels resulting from the hydrological measures. Where appropriate, level loggers will be used to provide higher-resolution water level records. Annual rainfall and evaporation data (using nearby stations) will be compiled alongside habitat condition assessments to track restoration progress and support adaptive management of measures if monitoring indicates under-performance.

Drain blocking of the arterial drain

Where re-establishment of 7140 Transition mire is an objective, restoration must aim to reintroduce persistently high and stable water tables, including reduction of drainage gradients and restoration of lateral water movement. In areas where hydrological alteration is substantial, full recovery may not be achievable in the short term.

A Lidar analysis of the arterial drain and the fen connections to the drain is needed. This should include an analysis of the water level in relation to the road. The M8 has a relatively high

elevation in comparison to the fen (81 mOD vs 79 mOD) but the local road does not. Additional constraints are the high nutrient levels in the arterial drain. Where feasible connection points into the arterial drain should be blocked, and following at least one year of monitoring then additional blocking could be proposed for the arterial drain itself. There will need to be nutrient attenuation prior to drain blocking through nutrient measures such as a constructed wetland

6.2.2 Off-site Hydrology Measures

6.2.2.1 Avoid creating new drainage channels adjacent to the site

No new drainage channels or artificial drains should be constructed adjacent to the site. Landowners to be advised that the creation of new drainage features in the vicinity of the site could adversely affect local hydrological conditions and undermine restoration objectives.

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 fen habitats.

6.3.1 On-site Nutrient Measures

Within SACs landowners must get consent from NPWS to undertake certain actions. The "activities requiring consent" related to nutrient measures include:

- Reclamation, including infilling.
- Cutting, uprooting or otherwise removing plants[9].
- Introduction, or re-introduction, of plants or animals not found in the area[6].
- Digging, ploughing, harrowing or otherwise disturbing soil or substrate[10].
- Applying inorganic or organic fertiliser, including slurry and farmyard manure[6].
- Application of pesticides, including herbicides[6].

Nutrient measures such as hedgerows will intercept the pathway of sediment and nutrients and will also act as a visual delineation of farmland vs wetland. Existing agri-environment

[9] Consent is not required for harvesting of cultivated crops, or for grazing or mowing.

[10] Consent is not required for these activities on established reseeded grassland or cultivated land provided it is greater than 20m from a river, stream or floodplain; or greater than 50m from a wetland, lake, turlough or pond.

frameworks such as Farming for Water EIP[11] or novel approaches under NPWS Farm Plans[12] can provide support to landowners in reducing nutrient loads to reduce the mobilisation and transport of nitrogen(N) and phosphorus (P) from agricultural land to the fen habitat.

6.3.1.1 Source control within site boundary

Suitable measures for Kilnaseer may include (Farming for Water EIP, 2023):

- Farmer Training Course for farmers within the fen site boundary. Training will create awareness of the benefits of improved land practices upstream of a fen.
- Nutrient Management Plan. Such a plan will enable farmers in the site boundary to consider alternative nutrient application

6.3.1.2 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. Monitoring of drainage channels and springs for water quality parameters including nutrients (nitrate and phosphate), electrical conductivity and pH is proposed

6.3.2 Off-site Nutrient Measures

Targeted nutrient control measures should be implemented across the catchment to address both phosphate and nitrogen pathways. PIP maps and field water quality data suggest that Phosphorus and Nitrate is high in the centre drain.

[11] The "Farming for Water" project provides funding to help farmers implement 43 measures designed to protect water quality by reducing pollution from nitrates, phosphorus, sediment, and pesticides. The project is a major initiative to reduce pollution from farming practices in Ireland and ensure that the country's rivers and other waterbodies are kept clean and healthy for the future and that we meet our obligations under the Water Framework Directive.

[12] The NPWS Farm Plan Scheme trials novel approaches to farming for the environment, to safeguard particular sites, habitats and species, and to work towards meeting conservation measures required under the EU Birds and Habitats Directives. Role players are the NPWS through the Agri-Ecology Unit, the regional staff of the NPWS and the farm participant.

PIP Measures outlined under the Farming for Water EIP[13] or novel approaches under NPWS Farm Plans[14] are categorised depending on if they address the source, pathway or receptor. Suitable measures for Kilnaseer may include:

Source control measures

- Farmer Training Course for farmers in the fen catchments.
- Nutrient Management Plan to support optimal slurry application and nutrient uptake, avoiding overapplication at nearby land.
- Nitrogen Surplus will allow for advisor/farmer discussions on how best to reduce excess nitrogen in the farming system by taking on measures to reduce nitrogen inputs and improve utilisation of existing nitrogen inputs.
- Multi – Species Swards (MSS), in terms of water quality, can help reduce the need for fertiliser applications while supporting steady plant growth.

Pathway interception measures:

- Hedgerow establishments are very effective in reducing the risk of fertiliser material being transported over sloping ground during periods of heavy rainfall or intense cloudbursts, particularly when planted perpendicular to the slope within overland flow pathways.
- Linear Riparian Buffer Zones due to the input of nitrate and phosphate.
- Tree planting along the main drain flowing west to north may be beneficial because trees absorb excess nutrients such as phosphorus to avoid further eutrophication flowing into the River Barrow and Nore SAC & SPA.

Receptor measures:

- Bovine, Ovine Exclusion from water bodies is important due to nutrient loss in the sites. Water bodies (including rivers, streams, drains, ponds, and lakes) should be

[13] The "Farming for Water" project provides funding to help farmers implement 43 measures designed to protect water quality by reducing pollution from nitrates, phosphorus, sediment, and pesticides. The project is a major initiative to reduce pollution from farming practices in Ireland and ensure that the country's rivers and other waterbodies are kept clean and healthy for the future and that we meet our obligations under the Water Framework Directive.

[14] The NPWS Farm Plan Scheme trials novel approaches to farming for the environment, to safeguard particular sites, habitats and species, and to work towards meeting conservation measures required under the EU Birds and Habitats Directives. Role players are the NPWS through the Agri-Ecology Unit, the regional staff of the NPWS and the farm participant.

fenced to restrict access by cattle and sheep. This measure helps minimise nutrient and sediment inputs and reduces the risk of bank erosion and destabilisation.

6.4 Vegetation Measures

6.4.1 On-site Vegetation Measures

Vegetation measures at Kilnaseer are focused on restoring and maintaining open fen vegetation structure within Annex I quality habitats by addressing scrub encroachment and rank vegetation associated with historical drainage and the abandonment of traditional grazing regimes resulting in undergrazing. Measures are targeted spatially based on field observations and mapped monitoring locations.

The following on-site vegetation measures are proposed:

- **Targeted scrub removal:** Localised removal of encroaching native scrub, primarily willow and alder, will be undertaken where scrub is directly impacting Annex quality fen habitats. Scrub removal will be prioritised along drainage-influenced margins and habitat edges identified during site surveys. Scrub will be retained where it contributes positively to habitat diversity, buffering functions, or the integrity of adjacent woodland habitats, including 91E0 Alluvial forests.
- **Management of rank vegetation:** Rank vegetation resulting from prolonged undergrazing will be addressed through the reintroduction of appropriate Low-intensity conservation grazing, with stocking rates, timing and duration tailored to site conditions, to control rank vegetation while avoiding poaching, nutrient enrichment and damage to sensitive fen communities. Grazing regimes will be carefully designed to reflect site sensitivity, with stocking levels, timing and duration informed by ground conditions to avoid poaching, nutrient enrichment or damage to wetter fen areas. Grazing will be implemented adaptively and reviewed through ongoing monitoring.
- **Vegetation monitoring:** Vegetation monitoring will be undertaken at established monitoring points to assess responses to management, including changes in vegetation structure, scrub regeneration and dominance of competitive species. Monitoring results will inform adaptive management and the need for follow-up interventions.

These vegetation measures are intended to operate in combination with hydrological restoration actions to support recovery of open fen conditions and characteristic vegetation communities.

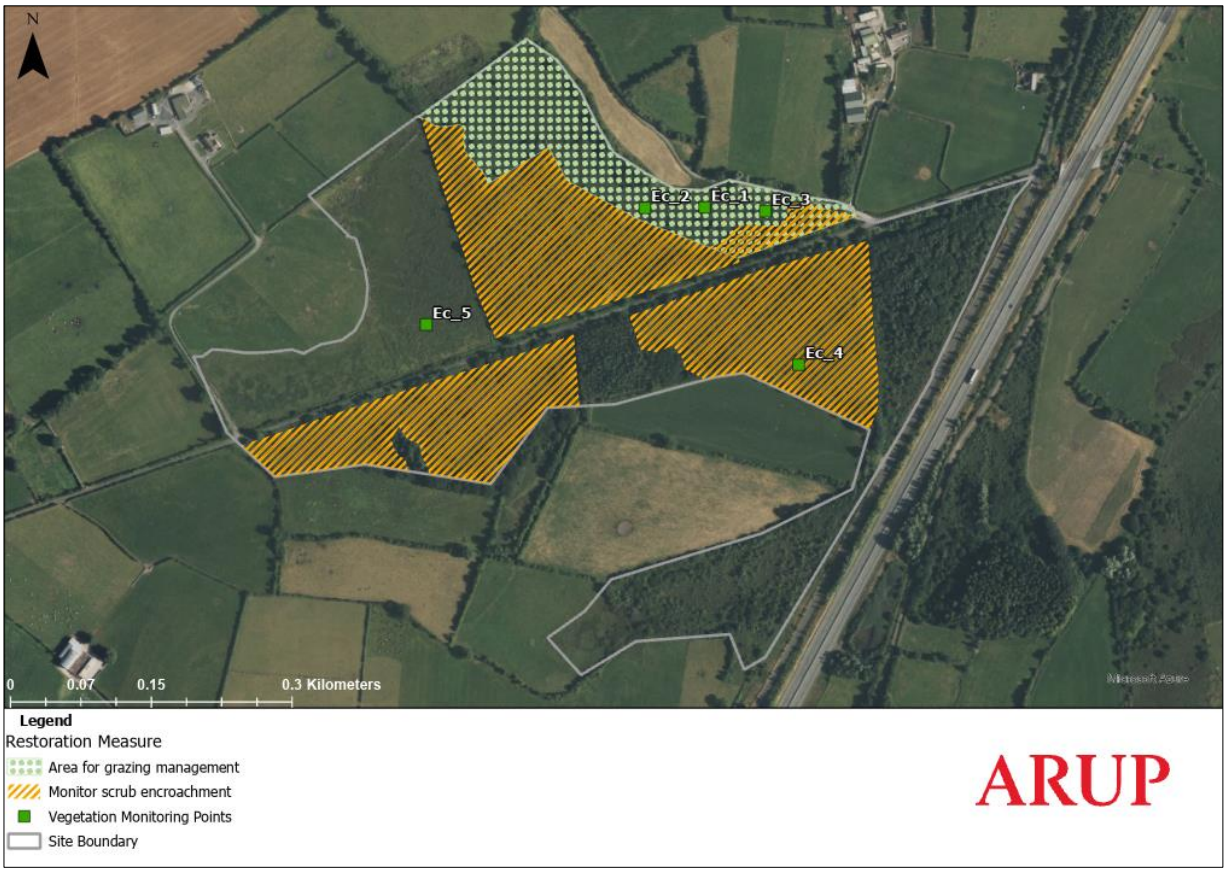


Figure 6-3: Proposed vegetation management measures and monitoring for Kilnaseer

6.4.2 Off-site Vegetation Measures

Off-site vegetation measures at Kilnaseer are limited and are intended to support the effectiveness of on-site actions by reducing external pressures on fen habitats.

The following off-site measures are proposed:

- Buffer zone management: Engagement with land management adjacent to the site will be undertaken, where relevant, to minimise scrub development, vegetation encroachment and other land-use pressures along site boundaries that could influence fen vegetation structure.
- Integration with hydrological measures: Off-site vegetation considerations will be integrated with wider hydrological and catchment measures to ensure that vegetation management within the site is not undermined by external influences.

No active off-site vegetation manipulation is proposed at this stage; measures will focus on prevention and long-term protection of restored vegetation communities.

7 Additional Considerations

7.1 Drainage Management Plan

The Kilnaseer Fen is part of a Drainage District managed by Laois County Council. Consultation is required with Laois County Council on the maintenance and function of the channel and the impact of future drainage plans on the fen and the impact of the proposed restoration measures on the objectives of the drainage district.

The preliminary drainage management plan for Kilnaseer is presented in Appendix D

7.2 Peat Stability Assessment

The GSI landslide susceptibility map for Kilnaseer is presented in Figure 7-1.

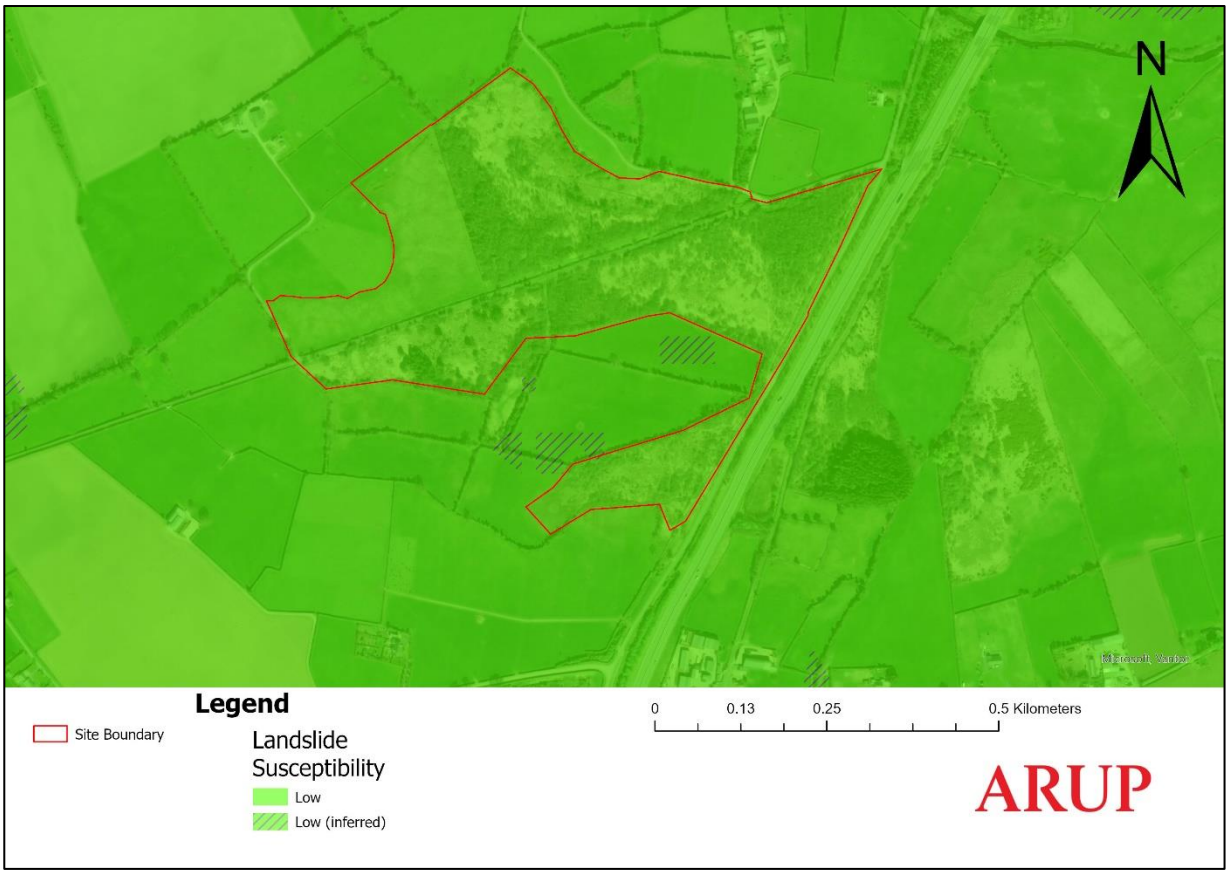


Figure 7-1 Geological Survey of Ireland Landslide Susceptibility mapping for Kilnaseer

7.3 Archaeology

The Kilnaseer site has no identified archaeological monuments, although the placename derives from Kill na Saor, church of the craftsman (logainm.ie). This is presented in (Figure 7-2).



Figure 7-2: Archaeological Sites for Kilnaseer (NMS, 2025)

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	National Monument Services / County Council	No archaeological sites have been identified on the site from the desk study. However, archaeologists will need to be engaged if potential sites are identified during the work.
	Landowners	Parts of Kilnaseer Fen are under Commonage ownership by private individuals
	NPWS	Kilnaseer Fen is within an SAC & the outflow from the fen flows into the River Nore SPA
Off-site	Landowners & farmers	Engagement for uptake of catchment measures.
	LAWPRO	Kilnaseer fen is within the Erkina Prioritised Area for Action under LAWPRO Cycle 3 (2022-2027).
Capacity building	NPWS	NPWS engaging in community education and events

This section provides the summary of the Fen Restoration Plan Actions for Kilnaseer (Table 8-2).

Table 8-2: Implementation plan for Kilnaseer 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.**							
	This report must outline all restoration measures that shall be undertaken as part of the project at Kilnaseer. The Screening for AA must conclude whether a likely significant effect is anticipated to arise from the implementation of the project.	Sitewide	Screening report	Pre-restoration	NPWS	Laois Co. Co	Arup	NPWS
1.2	**Drainage management plan**							
	Consultation with Laois Co. Co on the drainage management plan is required to ensure compliance with legislation and local authority objectives.	Sitewide	Drainage management plan	Pre-restoration	NPWS	Laois Co. Co	Arup	Within Tóchar project scope
1.3	**Archaeological assessment**							
	Consultation with the National Monument Service on the archaeology is required to ensure compliance with legislation and local authority objectives.	Sitewide	Archaeological assessment report	Pre-restoration	NPWS	Laois Co. Co	Arup	Within Tóchar project scope
2	**Enabling Works**							
2.1	**Pre-restoration Works Surveys**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	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 – identification of necessary mitigation measures. Such measures may include, but are not limited to, the utilisation of hand machinery to avoid impact on sensitive habitats	Sitewide	ECoW report	Pre-restoration			Arup	Within Tóchar project scope
2.3	**Breeding Bird Considerations**							
	Prior to restoration works, where any restoration measures are identified to have the potential to interfere with breeding birds e.g. scrub removal, these works shall occur outside the breeding bird season (1 March – 31 August inclusive).	Sitewide	ECoW report	Pre-restoration			Arup	Within Tóchar project scope
2.4	**Good Practice Recommendations and CEMP**							
	Good Practice Recommendations – Includes, but not limited to, avoidance of sensitive ecological receptors, pollution prevention procedures, biosecurity measures etc. The preparation and provision of a Construction Environmental Management Plan (CEMP).	Sitewide	ECoW report	Pre-restoration			Arup / Contractor	Within Tóchar project scope
3	**On-Site Restoration measures**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
3.1	**Hydrology measures**							
	Small internal drain blocking in the East of the site The internal drain will be blocked using peat to create peat dams, designed to slow water loss. The spatial distribution of the dam locations to be designed to limit the difference in water level upstream and downstream of the dam to 15-20cm in line best practice. The downstream connection to the arterial drain blocked with timber or plastic piling.	Eastern Small drain	Groundwater level	Restoration in 2026	NPWS to facilitate site access		Arup / Contractor	Within Tóchar project scope
	Drain blocking of arterial drain Lidar analysis to assess the hydraulic connection to the arterial drain. Where feasible connections should be blocked to allow for the fen to reinstate natural water levels. Monitoring is required prior to blocking the arterial drain.	Arterial drain	Groundwater level	Restoration in 2026	NPWS to facilitate site access	Laois Co. Co	Arup / Contractor	Within Tóchar project scope
3.2	**Vegetation measures**							
	1. Vegetation monitoring at identified monitoring points 2. Targeted scrub removal of encroaching native scrub on Annex quality 7230 Alkaline fen habitat 3. Low-intensity conservation grazing to reduce cover of rank vegetation	Site-wide with focus on Annex I quality habitats	Vegetation cover	Site records / habitat surveys	Restoration 2026	NPWS		Arup / Contractor
4	**Off-Site Restoration measures**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
4.1	**Hydrology measures**							
	District drainage management plan Engage with Laois Co. Co on the management of drainage within site.	Main drain following through site	Surface water	Long-term	NPWS/ Laois Co. Co			Laois Co. Co
4.2	**Nutrient measures**							
	Catchment nutrient management Targeted nutrient control measures should be implemented across the catchment to address both phosphate and nitrogen pathways. Suitable measures include farmer training. Nutrient management plans and nitrogen surplus, where applicable.	Fen catchment	Nutrients (Nitrate and phosphate), EC, pH	Long-term	NPWS, LAWPRO, Farming for Water EIP		Landowners	Farming for Water EIP/similar
	Agricultural nutrient management Promote livestock drinking point where appropriate and excluding livestock from fen for water supply.	Site boundary	Surface water	Long-term	NPWS		Landowner	Farming for Water EIP/similar
5	**Monitoring progress**							
5.1	**Hydrology monitoring**							
	Groundwater, surface water and lake level monitoring in a network of piezometers and standpipes at key locations within the site to monitor changes to water levels. Level loggers will be used to monitor changes in water levels.	Various locations within the site	Surface and ground water level	Long-term	NPWS			NPWS

	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			NPWS
5.2	**Nutrient monitoring**							
	Ongoing monitoring of drainage channels and springs for water quality parameters is proposed within the fen.	Various locations within the site	Nutrients (Nitrate and phosphate), EC, pH	Long-term	NPWS			NPWS
5.3	**Vegetation monitoring**							
	Habitat condition assessments will be included to track restoration progress.	Sitewide	Habitat condition	Long-term	NPWS			NPWS
6	**Capacity building and training**							
	Public meeting: To engage stakeholders on developments and results from the restoration measures.	Sitewide	Public awareness	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	Sitewide	Farmer awareness	Long-term	NPWS/ Farming for Water EIP / LAWPRO / Teagasc			Farming for Water EIP / other similar

8.1 Habitats Benefiting from Implementation of Restoration Actions

The proposed restoration measures at Kilnaseer are expected to deliver significant benefits across the site by addressing the key pressures of drainage, undergrazing and scrub encroachment. Restoration of more natural hydrological conditions, combined with targeted vegetation management, will support improved habitat structure and function across Annex I fen habitats and associated wetland communities.

7230 Alkaline fen

Hydrological restoration through targeted drain blocking will increase and stabilise water tables, restoring base-rich, groundwater-fed conditions that underpin this habitat. In combination with scrub removal and appropriate grazing management, this will reduce dominance of *Molinia caerulea* and woody species, support recovery of species-rich swards, and improve structural diversity. These changes will enhance habitat resilience and support progression towards favourable conservation condition.

7140 Transition mire

Restoration of wetter conditions will reduce peat surface drying and limit further degradation caused by drainage. The re-establishment of low-intensity grazing and removal of encroaching scrub will reduce rank vegetation and shading, thereby supporting the recovery of characteristic species assemblages and open mire structure. These measures will improve habitat heterogeneity and help reverse the unfavourable condition currently identified.

7210 Cladium fen

While relatively localised but currently in favourable condition, the primary benefit will be protection and maintenance of existing habitat quality. Hydrological restoration will help safeguard water levels adjacent to drainage features, reducing the risk of localised drying. Targeted management of scrub at habitat margins and appropriate grazing will prevent encroachment and structural degradation, maintaining the integrity of Cladium mariscus-dominated vegetation.

91E0 Alluvial forests and associated WN6 wet woodland

Restoration measures will provide indirect benefits through improved site hydrology and protection of surrounding fen habitats. Retention of wet woodland while controlling scrub encroachment at fen margins will maintain its ecological function while preventing expansion into open fen systems. These habitats will continue to provide buffering, filtration and structural diversity within the wider wetland mosaic.

Non-Annex habitats, including wet grassland (GS4), reed swamp (FS1), tall-herb swamp (FS2) and raised bog (PB1), will also benefit indirectly. Restoration actions will maintain their contribution to hydrological connectivity and habitat diversity, while preventing further degradation associated with drainage and encroachment.

Overall, the combined restoration measures will restore a more coherent and functionally connected wetland system, supporting the recovery and long-term stability of fen habitats across Kilnaseer.

8.2 Species Benefiting from Implementation of Restoration Actions

The proposed restoration measures will benefit a range of plant and animal species associated with fen and wetland habitats by improving hydrological conditions, restoring vegetation structure and enhancing habitat connectivity.

Fen specialist plant species, including black bog-rush and marsh helleborine, will benefit from the restoration of high-water tables and reduction in competition from rank grasses and scrub. These conditions will promote the persistence and potential expansion of species indicative of 7230 Alkaline fen and other base-rich wetland habitats. Management of *Molinia caerulea* dominance through grazing and hydrological restoration will further improve conditions for species-rich fen communities.

Species associated with structurally diverse wetland habitats, including Devil's-bit scabious, will benefit from increased habitat heterogeneity resulting from combined hydrological and vegetation management. This in turn will support invertebrate species reliant on these plant communities, including Small Eggar and other wet grassland and fen-associated taxa.

Hydrological restoration and improved vegetation structure will enhance habitat suitability for amphibians such as the common frog, supporting breeding and foraging opportunities through increased availability of shallow, wet habitats.

Wetland bird species recorded within the site, including water rail, will benefit from improved vegetation structure and the maintenance of wet conditions within fen, swamp and marsh habitats. Increased habitat quality and connectivity within the site may also support species recorded within the wider zone of influence, such as waders and waterfowl associated with open wetland systems.

At a broader ecological scale, restoration of hydrological connectivity and reduction of fragmentation will enhance the site's contribution to the wider landscape as part of the River Barrow and River Nore SAC, supporting mobile and functionally connected species groups.

Collectively, the restoration measures will improve habitat quality, increase ecological resilience and support the long-term viability of species associated with fen and wetland ecosystems at Kilnaseer.

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	Kilnaseer	**NFS site no.**	*002162*
County	Laois	**Designation**	*SAC*
Fen habitats present (area)	7140 Transition mires 7210 Cladium fen 7230 Alkaline fen	**Species of note**	1016 *Vertigo moulinsiana*

Site Description

The Kilnaseer site is within the boundary of the River Barrow and River Nore Special Area of Conservation (SAC) (site code: 002162) and is located 5 km east of Rathdowney in a lowland landscape of improved pasture in Laois. The site covers a total area of 23.55ha and is dominated by7140 Transition mire, 7210 Cladium fen and 7230 Alkaline fen habitats within the site which contributes to favourable conservation condition of the fen habitat on site. The designations for the River Barrow and River Nore SAC relevant to Kilnaseer are 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicionalbae)* (Hereafter referred to as 91E0 Alluvial forests), which occurs in the centre of the site and in which a small area of Annex quality 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (Hereafter referred to as 6430 Hydrophilous tall herb fringe communities) exists, and 1016 *Vertigo moulinsiana* (Desmoulin's whorl snail), which has been recorded immediately adjacent to the northern boundary of the site.

Conceptual Site Model (CSM)

Kilnaseer occurs at an elevation of 79 mOD within a lower lying basin and is surrounded by hillslopes at 87 mOD to the north-east and south-west. In its natural condition the site would have been connected to the wider wetland system of the River Barrow and River Nore SAC. The historical and more recent modifications to the site have had significant effects on the fen hydrology and habitat health. This has constrained the site to the west, disconnected it from surrounding habitats and drained the central basin towards the M8 culvert and onwards to the downstream tributary of the Erkina River.

Although there were no springs or wells identified within the site boundaries by the NFS (Brophy, In Prep), field surveys to the east outside of the site boundary indicated a presence of Annex I quality 7220 Petrifying springs. Historically the River Barrow and River Nore SAC had springs identified and there is an upstream spring to the south, which was previously captured within a reservoir and directed towards a mill race. This indicates that there is likely groundwater connection within and around the wetland. The desk study and field survey results indicate that the bedrock is a karstified limestone (Ll aquifer) that provides a direct hydraulic connection to the fen.

The classification for Kilnaseer in its natural condition should be **WETMEC 9a: Groundwater-Fed Bottoms**, in connection to the wider wetland system being fed from springs representing

WETMEC 16a: Groundwater flushed bottom in the region of springs. The surface water within the arterial drain is being fed by an upstream spring and within the site boundary there is evidence of tufa springs.

Modifications to the natural condition of the site have meant that portions of wetland on either side of the local road are currently in the state of WETMEC 9b: Part-Drained Groundwater Bottom under the influence of historical and current drainage. As it is unlikely that the central drain can be altered due to the association to the local and upgraded road, the focus for restoration will be on local hydrology improvements within the site boundary.

The primary habitats across the site occur in the form of a mosaic of Annex quality 7140 Transition mire and 7230 Alkaline fens with small patches of 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* present within the 7230 Alkaline fens habitat in the northern area of the site.

Key Pressures	
Hydrology Pressures	Drainage has been identified as a key pressure. There is an arterial drain that traverses the fen from south-west to north-east. This drain is up to 3m deep and 7m wide and is likely exerting a significant control on the water levels in the fen. There are smaller drains off the fen that connect to the drain and create local controls on water levels. One drain located within the habitat to the east shows localised impacts and has been highlighted as pressures requiring targeted management. The identified 7220 Petrifying springs habitat can be particularly sensitive to changes in groundwater discharge, water chemistry, and nutrient status. Drainage and alteration of flow paths may reduce groundwater upwelling, while elevated nutrient concentrations can disrupt tufa-forming processes and associated bryophyte communities.
Nutrient Pressures	Diffuse pollution from agricultural activities represents a potential nutrient pressure on the fen habitats at Kilnaseer. The surrounding land use is predominantly agricultural, and nutrient transport pathways identified through EPA PIP mapping indicate areas of elevated risk for phosphorus and nitrate delivery to the site's drainage network. Water quality monitoring undertaken as part of this FRP recorded elevated nitrate and phosphate concentrations within the site drains, particularly within the main arterial channel that traverses the site. Nitrate concentrations exceeded groundwater threshold values at both the south-west inflow and the site outflow locations, while phosphate concentrations exceeded WFD good status thresholds at all monitored locations. The highest phosphate concentration was recorded

	within the central drain, suggesting influence from adjacent agricultural land use.
Ecology Pressures	• **Drainage** Drainage alters local hydrology, lowering water tables and facilitating habitat drying, which in turn promotes scrub encroachment and changes in fen vegetation structure. • **Abandonment of traditional grazing regimes** Large areas of fen are currently ungrazed or no longer subject to the low-intensity grazing regimes that historically helped maintain open fen vegetation. • **Scrub encroachment** Localised but increasing encroachment by native scrub species, particularly willow (*Salix spp*.) and alder, is evident within fen habitats. Scrub establishment is most pronounced along drainage-influenced margins and habitat edges, where altered hydrological conditions and reduced grazing pressure promote succession.
Objective of Restoration Plan	
The main aim of the restoration actions proposed as part of this assessment is to maintain or improve the quality of existing areas of fen or improve the hydrological conditions that will allow an expansion of the measurable area of fen thus impacting on favourable condition of the fen. However, in some areas, it must be recognised that restoration to increase areas of existing fen will not be possible due to unsuitable hydrological conditions, and the objective may simply be to ensure no further deterioration	
Restoration Measures	
Hydrology Measures	**On-Site Measures:** • Small internal drain blocking in the East of the site • Drain blocking of arterial drain **Off-Site Measures:** Avoid creating new drainage channels adjacent to the site; Engage with OPW on the management of arterial drainage channels to the north and south.
Nutrient Measures	**Off-Site Measures:** Agricultural nutrient management: Promote livestock drinking point where appropriate and excluding livestock from fen for water supply. Catchment nutrient management: Targeted nutrient control measures should be implemented across the catchment to address both phosphate and

	nitrogen pathways. Suitable measures include farmer training. Nutrient management plans and nitrogen surplus, where applicable.
Ecology Measures	**On-Site Measures:** Vegetation monitoring at identified monitoring points ; Targeted scrub removal of encroaching native scrub on Annex quality 7230 Alkaline fen habitat, Low-intensity conservation grazing to reduce cover of rank vegetation
Monitoring	
Hydrology Monitoring	Groundwater and surface water monitoring within the fen as well as rainfall and evaporation monitoring.
Nutrient Monitoring	Ongoing monitoring of groundwater and surface water for water quality parameters within the fen
Ecology Monitoring	Habitat condition assessments to monitor the rate, if any, of succession and/or general scrub encroachment which in turn will inform the need for further works
More information	
Fen Restoration Plan Report Tóchar website: https://www.tocharwetlands.ie/fen-restoration/	

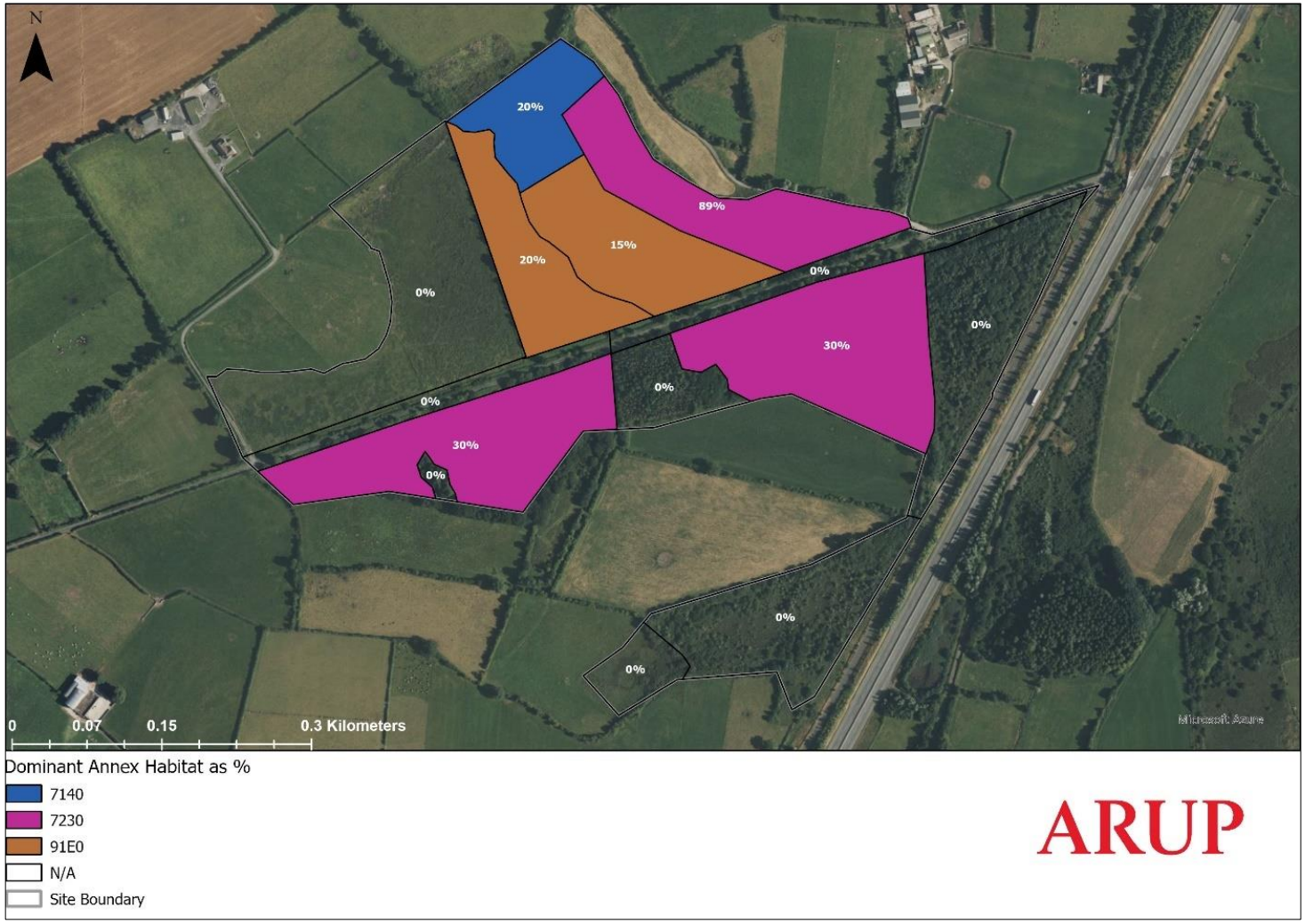


Figure 1: Site Habitat Map

Kilnaseer
County Laois
WFD catchment: Nore (ERKINA_050)
WETMEC 9b: Groundwater fed bottom

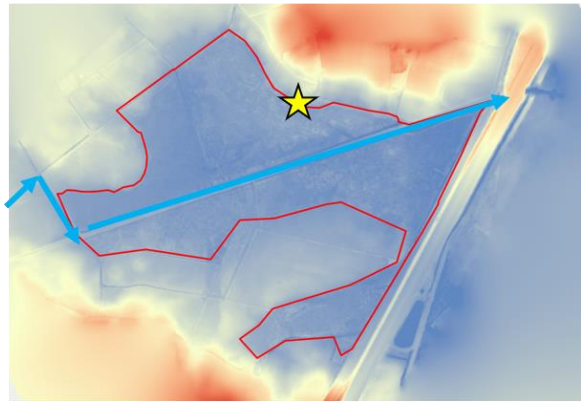
Water key:

- Drains
- Spring
- Wetland vegetation

Cross section:



Water input/output:



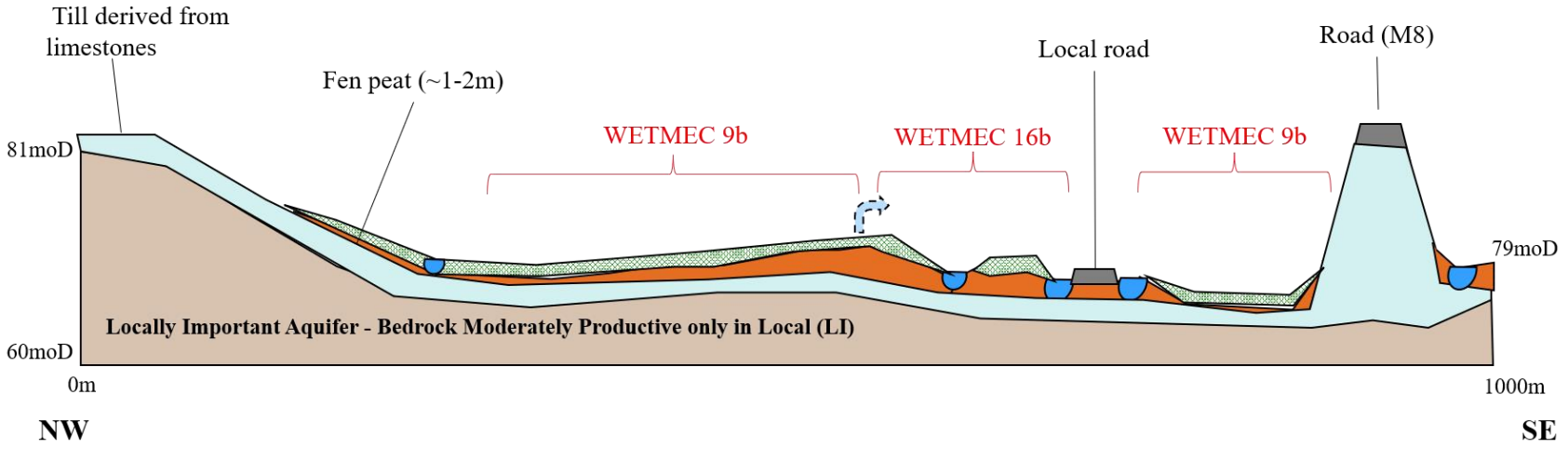


Figure 2: Conceptual Site Model

Appendix B – Ecological Survey Maps

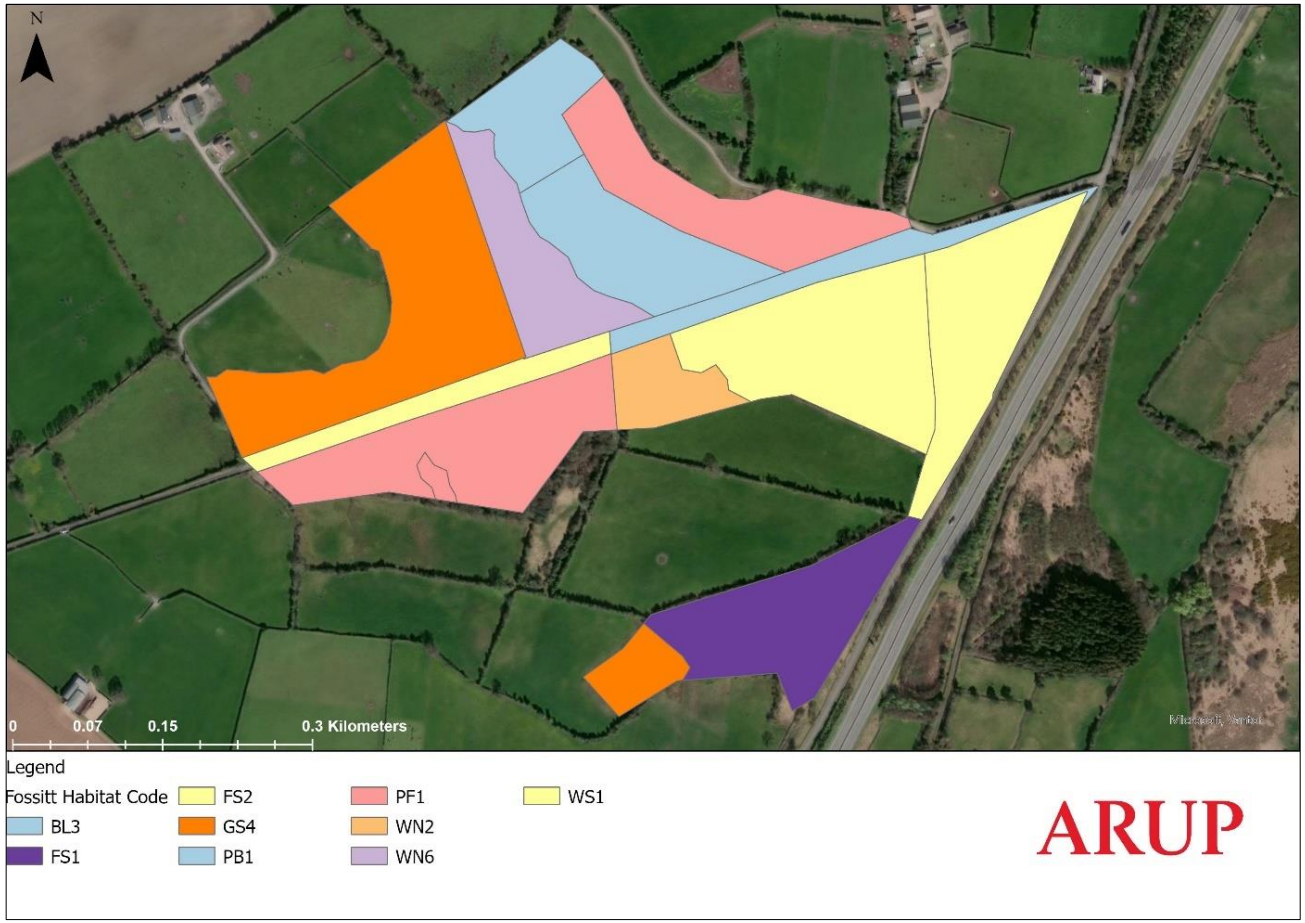


Figure 9-1: Habitats recorded during the 2022 NFS and classified according to the Fossitt Habitat Classification system. See Table 9-1 for the full directory of habitat codes and names.

Table 9-1 Annex I habitat codes and Fossitt habitat code directory

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
3110	Oligotrophic Isoetid lake habitat	FL1	Dystrophic lakes
3130	Slender Naiad-type lakes	FL2	Acid oligotrophic lakes
3140	Hard-water lakes	FL3	Limestone/marl lakes
3150	Rich pondweed lake habitat	FL4	Mesotrophic lakes
3160	Acid oligotrophic lakes	FL5	Eutrophic lakes
3180	Turloughs	FL6	Turloughs
3260	Vegetation of flowing waters	FL7	Reservoirs
3270	Chenopodion rubri	FL8	Other artificial lakes and ponds
4010	Wet heaths	FW1	Eroding/upland rivers
4030	Dry heaths	FW2	Depositing/lowland rivers
4060	Alpine and subalpine heath	FW3	Canals
5130	Juniper scrub	FW4	Drainage ditches
6130	Calaminarian grasslands	FP1	Calcareous springs
6210	Orchid-rich calcareous grassland	FP2	Non-calcareous springs
6230	Species-rich Nardus grassland	FS1	Reed and large sedge swamps
6410	Molinia meadows	FS2	Tall-herb swamps
6430	Hydrophilous tall-herb swamp	GA1	Improved agricultural grassland
6510	Hay meadows	GA2	Amenity grassland (improved)
7110	Raised bog (active)	GS1	Dry calcareous and neutral grassland
7120	Degraded raised bogs	GS2	Dry meadows and grassy verges
7130	Blanket bog (active)	GS3	Dry-humid acid grassland
7140	Transition mires	GS4	Wet grassland
7150	Rhynchosporion depressions	GM1	Marsh
7210	Cladium fens	HH1	Dry siliceous heath
7220	Petrifying springs	HH2	Dry calcareous heath
7230	Alkaline fens	HH3	Wet heath
8110	Siliceous scree	HH4	Montane heath

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
8120	Calcareous scree	HD1	Dense bracken
8210	Calcareous rocky slopes	PB1	Raised bog
8220	Siliceous rocky slopes	PB2	Upland blanket bog
8240	Limestone pavement	PB3	Lowland blanket bog
8310	Caves	PB4	Cutover bog
8330	Sea caves	PB5	Eroding blanket bog
91A0	Old oak woodland	PF1	Rich fen and flush
91D0	Bog woodland	PF2	Poor fen and flush
91E0	Alluvial woodland	PF3	Transition mire and quaking bog
91J0	Yew woodland	WN1	Oak-birch-holly woodland
		WN2	Oak-ash-hazel woodland
		WN3	Yew woodland
		WN4	Wet pedunculate oak-ash woodland
		WN5	Riparian woodland
		WN6	Wet willow-alder-ash woodland
		WN7	Bog woodland
		WD1	(Mixed) broadleaved woodland
		WD2	Mixed broadleaved/conifer woodland
		WD3	(Mixed) conifer woodland
		WD4	Conifer plantation
		WD5	Scattered trees and parkland
		WS1	Scrub
		WS2	Immature woodland
		WS3	Ornamental/non-native shrub
		WS4	Short rotation coppice
		WS5	Recently-felled woodland
		WL1	Hedgerows
		WL2	Treelines
		ER1	Exposed siliceous rock
		ER2	Exposed calcareous rock
		ER3	Siliceous scree and loose rock
		ER4	Calcareous scree and loose rock

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
		EU1	Non-marine caves
		EU2	Artificial underground habitats
		ED1	Exposed sand, gravel or till
		ED2	Spoil and bare ground
		ED3	Recolonising bare ground
		ED4	Active quarries and mines
		ED5	Refuse and other waste
		BC1	Arable crops
		BC2	Horticultural land
		BC3	Tilled land
		BC4	Flower beds and borders
		BL1	Stone walls and other stonework
		BL2	Earth banks
		BL3	Buildings and artificial surfaces

Appendix C – Restoration and Monitoring Map

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

Point	Measure	Objective	Timeframe	Frequency of monitoring	Monitoring indicator
Gw_1	Hydrological	Monitoring groundwater levels and quality	Long-term	Seasonal[15] for year 1 Annual for year 2-5	Groundwater level
Gw_2					Groundwater level
Gw_3					Groundwater level
Gw_4					Groundwater level
Gw_5					Groundwater level
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 open water drain
Sw_2					Water level and quality at open water drain

[15] Seasonal: once in winter and once in summer to represent a hydrological year

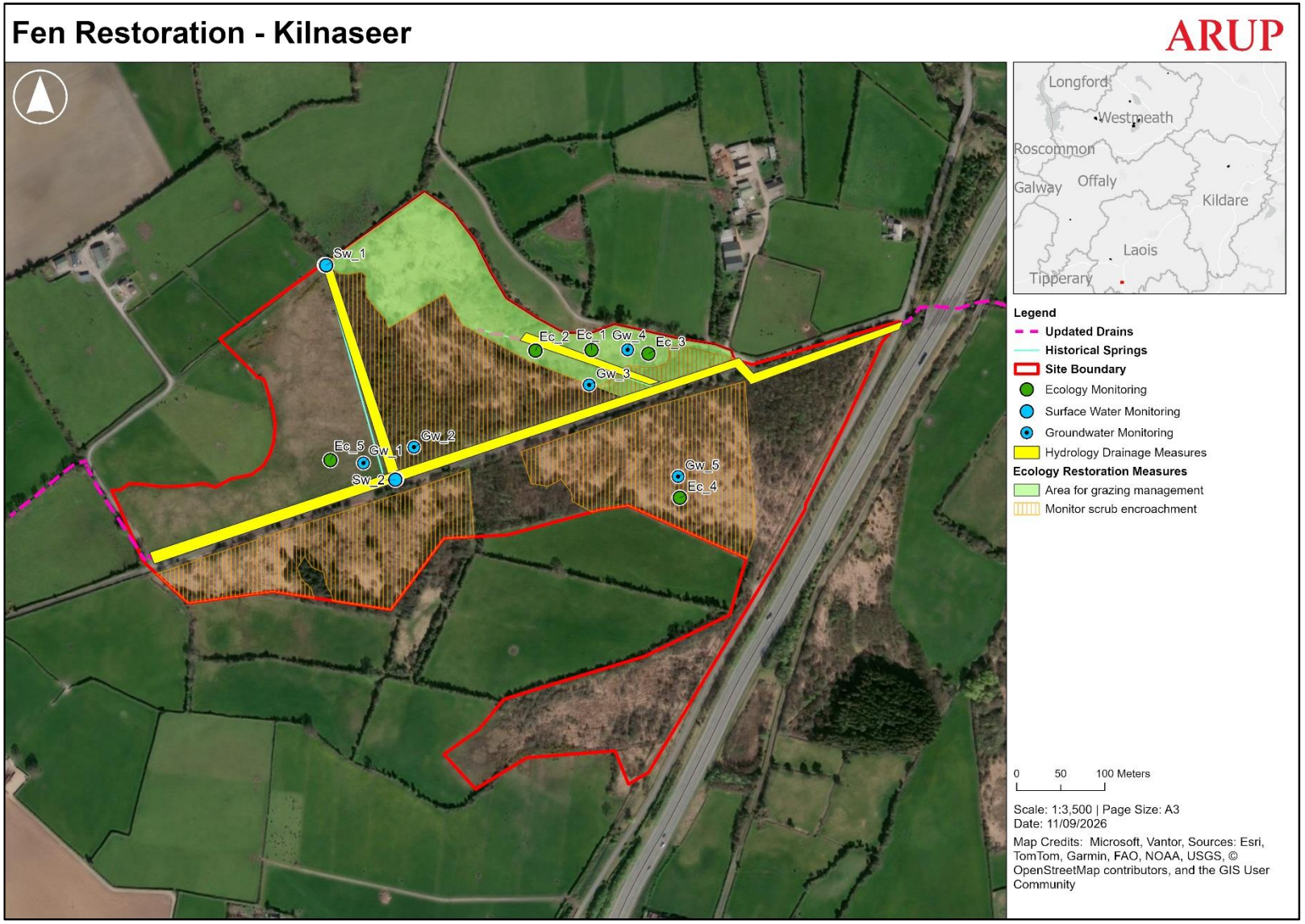


Figure 9-2: Restoration and monitoring for Kilnaseer

Appendix D – Drainage Management Plan

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan: Drainage Management Plan			
Site name	Kilnaseer		
County	Laois	NFS site No.	002162

Catchment overview:

The Kilnaseer site is within the boundary of the River Barrow and River Nore Special Area of Conservation (SAC) (site code: 002162) and is located 5 km east of Rathdowney in a lowland landscape of improved pasture in Laois. Kilnaseer occurs at an elevation of 79 mOD within a lower lying basin and is surrounded by hillslopes at 87 mOD to the north-east and south-west. In its natural condition the site would have been connected to the wider wetland system of the River Barrow and River Nore SAC. The historical and more recent modifications to the site have had significant effects on the fen hydrology and habitat health. This has constrained the site to the west, disconnected it from surrounding habitats and drained the central basin towards the M8 culvert and onwards to the downstream tributary of the Erkina River.

WFD catchment	Nore Catchment (Catchment ID:15)	WFD Sub-catchment	Nore_SC_050
Drainage Area	N/A	Drainage District	Yes
Responsible authority	Laois County	Maintenance date	Not confirmed yet
Surrounding landowners	Private		

Wetland drainage

The site is positioned at approximately 79 mOD to 86 mOD and is within a depression with higher ground northeast and southwest on surrounding hillslopes. The site is relatively flat within the centre. Farms extend around the boundary, and the fen vegetation is distinct from agriculture land use.

The drainage of the site has gone through various modifications over the years. The 25-inch map from 1897-1913 indicates that there was a spring to south-west of the site that was redirected towards a reservoir at Carrick House. The flow was then controlled by a sluice to be directed into a mill race. Flow from the mill race was directed around the wetland system from the west to east to join a tributary of the Erkina River. The wetland system is part of the River Barrow and River Nore SAC and had multiple spring inputs on the southern edge of the system.

More recently the drainage efficiency was increased through the upgrade to the M8 in 2010.The upgraded road disconnected the wetland from the western system and increased drainage efficiency through upgrading the culvert at the road. There is also an attenuation pond on the opposite side of the upgraded road, which is likely related to the upstream spring in that area.

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan: Drainage Management Plan			
Surface water inflow	Spring to the west	Surface water outflow	Culvert to stream under M8 and out to the Erinka_50.
Groundwater inflow	Karst bedrock suggests groundwater influence		
Internal drains	Yes	Perimeter drains	Yes
On site hydrology measures			
• Small internal drain blocking in the East of the site • Drain blocking of arterial drain			
Off-site hydrology measures			
Off-site measure 1	Avoid creating new drainage channels	Role player	NPWS/Surrounding landowners/Coillte
Landowners engaged about avoiding creating new drainage channels.			
Off-site nutrient measures			
Off-site measure 1	Agricultural nutrient management	Role player	Landowners, NPWS
Agricultural nutrient management: Promote livestock drinking point where appropriate and excluding livestock from fen for water supply. Catchment nutrient management: Targeted nutrient control measures should be implemented across the catchment to address both phosphate and nitrogen pathways. Suitable measures include farmer training. Nutrient management plans and nitrogen surplus, where applicable.			
Water Monitoring			
Groundwater and surface water monitoring in a network of piezometers and standpipes at key locations within the site to monitor changes to water in order to establish if onsite measures area required such as drain blocking.			

Indicator	Water level	Location	Various locations across site	Role players	NPWS
A hydrological monitoring programme will be implemented, including the installation of piezometers and the use of existing piezometers. The network will include a transect of five piezometers located across the southern part of the transition mire as well as a piezometer located closer to the mapped drainage network. The water level dynamics in the transition mire and the scrub removal area will be monitored by level loggers installed in the piezometers.					

Rainfall and evaporation monitoring is proposed using the nearby Met Eireann weather station at Mullingar.

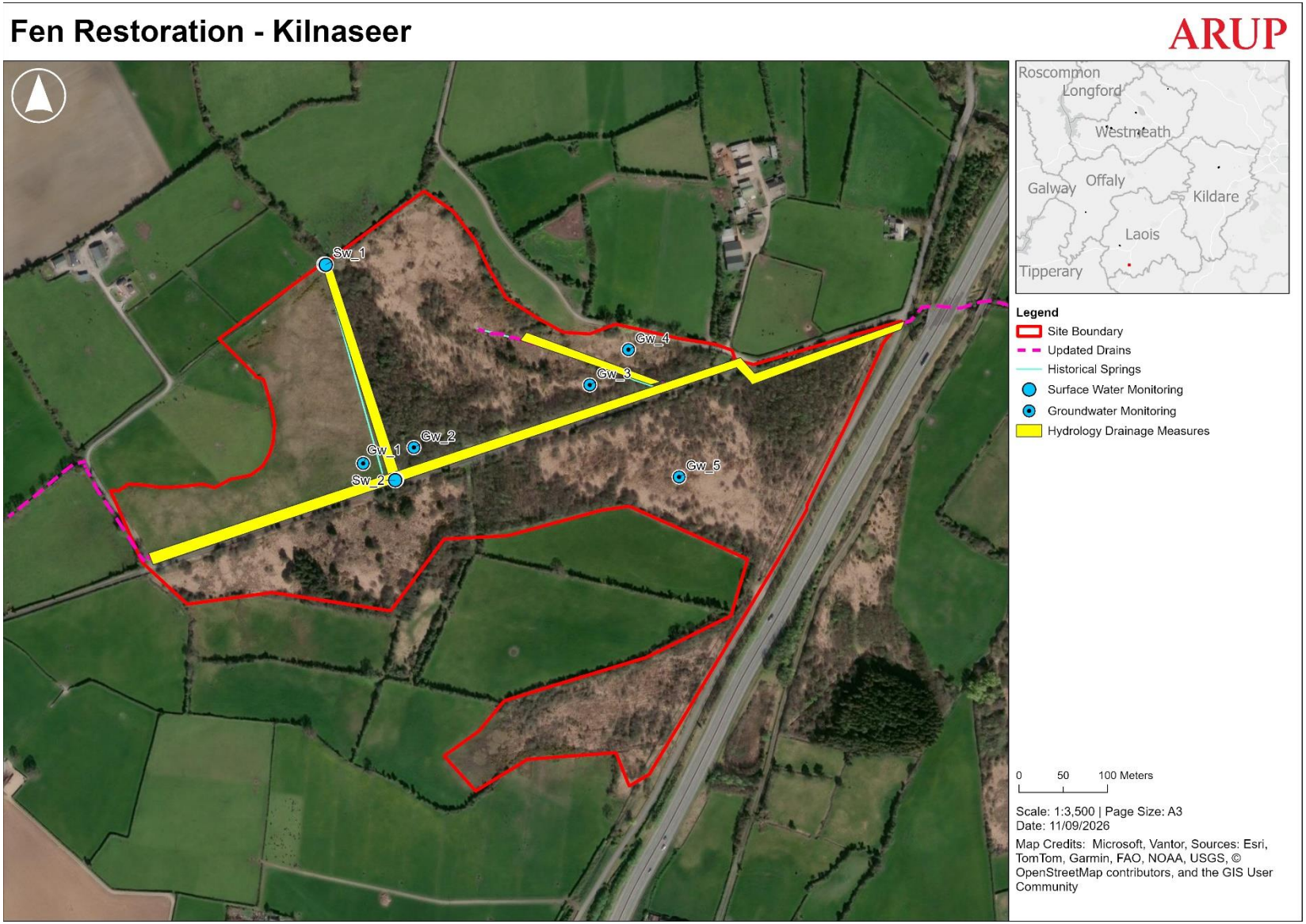


Figure 1: Hydrology measures and monitoring at Kilnaseer