National Parks & Wildlife Service

Tóchar Midlands Wetland Restoration Scheme

Ballymore

Fen

NFS site No.

104011

SAC 002313

Fen Restoration Plan

May 2026

Tóchar
Athchóiriú Bogach Lár na Tíre
Midlands Wetland Restoration

ARUP

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An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra
National Parks and Wildlife Service

Fen Restoration Plan

Ballymore Fen (Westmeath) SAC (002313)

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ARUP

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The National Parks and Wildlife Service.

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Executive Summary

Ballymore Fen is located 17k m west of Mullingar, Co. Westmeath and has been designated as a Special Area of Conservation (SAC) for the presence of 7140 Transition mire listed under Annex I and II of the EU Habitats Directive. The transition mire habitat covers the northeastern section of the site as well as the southern to central belt. The remainder of the site is represented by areas of Annex I quality 7230 Alkaline fens, however, these are not designating features of the site as well as non-Annex I habitat including dry calcareous and neutral grassland, wet grassland and improved agricultural grassland.

Actions of the Fen Restoration Plan

The restoration plan for Ballymore Fen sets out a coordinated series of measures to address the key pressures affecting the site and to support the recovery of its unique wetland habitats. Central to the plan is the management of vegetation.

The hydrological restoration objective for Ballymore Fen SAC is to improve areas 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 arterial drains, the objective for the site will be to focus on smaller drains in support of local water level improvement for 7140 Transition mire habitat to the south.

To address nutrient and pollution pressures on-site source control and pathway interception measures are promoted to improve land use practices within the site boundary. To address nutrient and pollution pressures off-site, the plan emphasises collaboration with local landowners and farmers through established programmes and incentives. This includes efforts to reduce nutrient runoff from surrounding agricultural land, as well as the provision of alternative livestock watering solutions to prevent direct access to the fen. Regular water quality assessments will be conducted to monitor nutrient levels and inform adaptive management of the site.

Finally, the plan recognises the importance of stakeholder engagement and compliance. Active engagement with landowners, statutory bodies, and other local stakeholders will help ensure that restoration actions are practical, widely supported, and compliant with relevant legislation. The plan also includes measures to protect archaeological features and to assess and manage any risks to peat stability, thereby safeguarding both the cultural heritage and the physical integrity of the site.

Benefits of the Fen Restoration Plan

The restoration plan is expected to deliver significant benefits for a range of habitats and species at Ballymore Fen. Overall, these restoration actions will enhance habitat quality and resilience, supporting both biodiversity and the site's long-term conservation objectives.

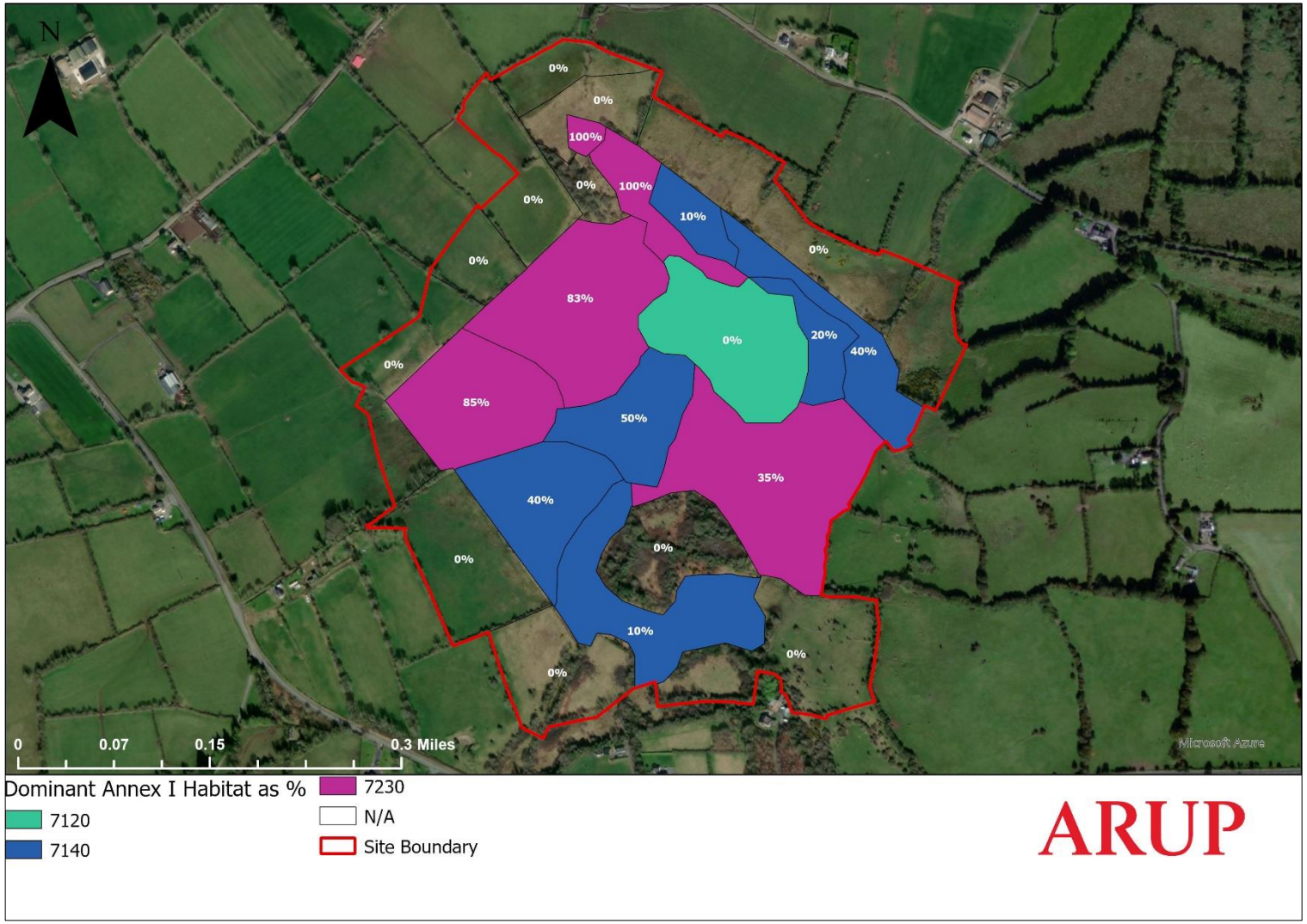


Figure 1-1: Annex I and Annex I quality habitats recorded and mapped as part of the 2023 National Fen Survey. Note the % value indicates the % cover of the dominant Annex I and Annex I quality habitat recorded in the polygon

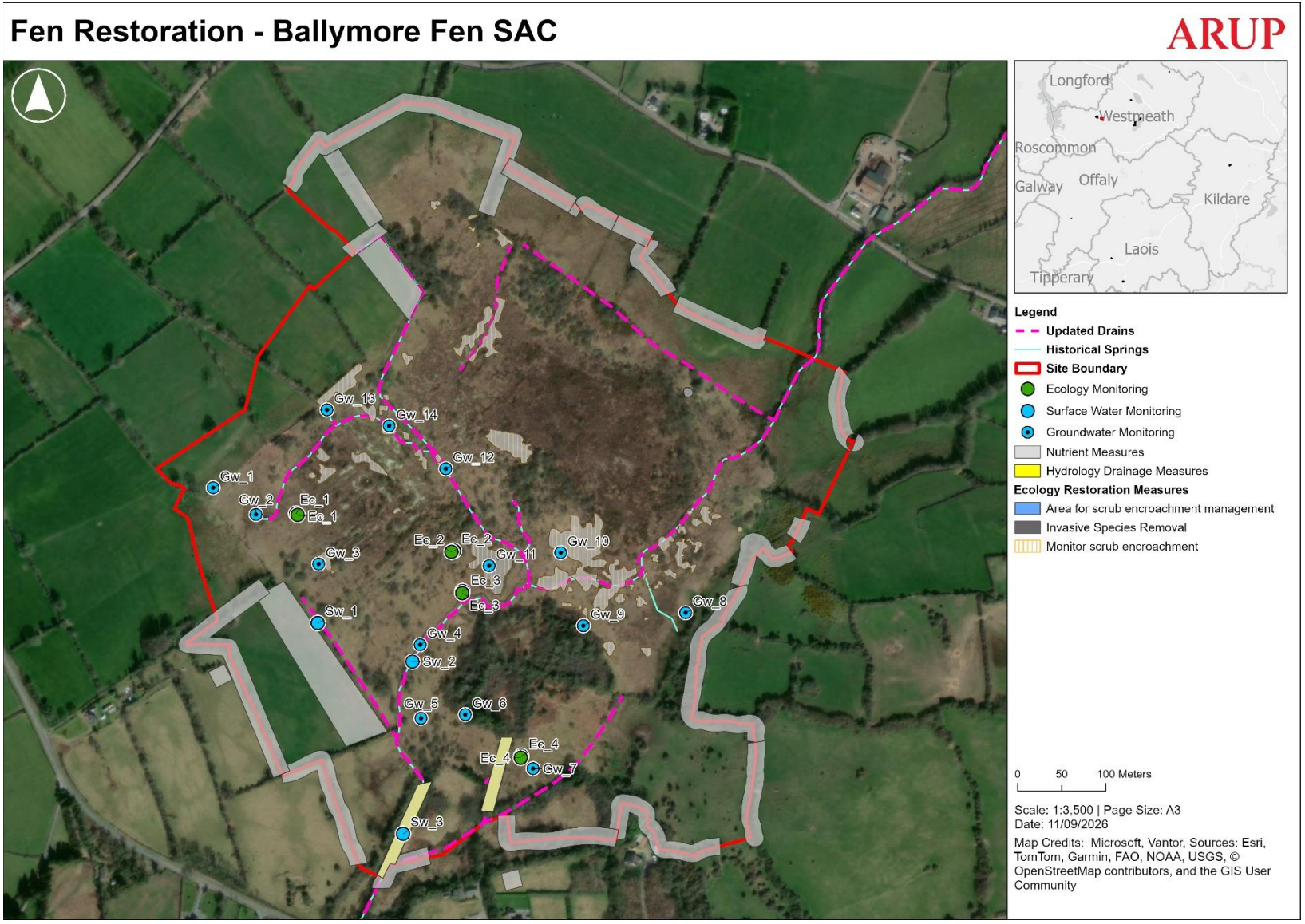


Figure 1-2: Restoration and monitoring map

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.

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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.

The FENCES Project is an interdisciplinary research initiative focused on understanding Ireland's calcareous fens that provide vital ecosystem services led by Trinity College Dublin (TCD) in the Civil, Structural & Environmental Engineering discipline.

1.1 Key pressures on Fens

The overarching (National) key pressures and threats to 7140 Transition mires habitats 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 mires in the Article 17 report.

Table 1-1: National pressures to fen habitats

Habitat	Importance	Pressure
7140 Transition mires	High	PA09 Burning for agriculture PA13 Application of natural or synthetic fertilisers on agricultural land PA22 Drainage for use as agricultural land PF02 Construction of modification (e.g. of housing and settlements) in existing built-up areas PL02 Drainage (mixed or unknown drivers) B01 Conversion to forest from other land uses, or afforestation J01 Mixed source pollution to surface and ground waters K02 Drainage K04 Modification of hydrological flow
	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 forestry systems (e.g. cessation of grazing, mowing or traditional farming) PA07 Intensive grazing or overgrazing by livestock

Habitat	Importance	Pressure
		PA21 Active abstraction of water for agriculture PB01 Conversion to forest from other land uses, or afforestation (excluding drainage) PB26 Other forestry activities, excluding those relating to forestry PC05 Peat extraction PF06 Deposition and treatment of waste/rubbish from built-up areas PI02 Other invasive alien species (other than species of Union concern)

1 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] I 7140 Transition mires and quaking bog (hereafter referred to as 7140 Transition mires) within the site which contributes to favourable conservation condition of the fen habitat and the achievement of SAC site-specific conservation objective (SSCO) targets. In addition, the following Annex I quality habitats were recorded on site 7230 Alkaline fens and 7120 Degraded raised bogs still capable of natural regeneration (hereafter referred to as 7120 Degraded raised bogs). Annex I quality referred to here means it conforms to the Annex I habitat description, but is not a designated feature of the Special Area of Conservation (SAC).

Ballymore Fen SAC (site code: 002313) is located approximately 17km west of Mullingar in Co. Westmeath. The SAC covers a total area of 42.71 ha and is dominated by fen habitat although several other associated peatland habitats are also present (Brophy, In prep).

The main aim of the restoration actions proposed as part of this assessment is to maintain or improve the quality of existing areas of 7140 Transition mires or improve the hydrological conditions that will allow an expansion of the measurable area of Annex I quality 7230 Alkaline, 7120 Degraded raised bogs and non-annex fen habitats, thus impacting on Site Specific Conservation Objectives (SSCOs)/favourable condition of the site. However, in some areas, it must be recognised that restoration to increase areas of existing 7140 Transition mires, Annex I quality 7230 Alkaline fens, 7120 Degraded raised bogs and non-annex fen habitats will not be

[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.

possible due to unsuitable hydrological conditions, and the objective may simply be to ensure no further deterioration.

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 peatland 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 minimize flood risks. Beyond their ecological importance, fens hold cultural, historical, and recreational value, offering opportunities for education, research, and outdoor activities. Although some fens in Ireland are not protected as 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.

It is expected that areas within Ballymore Fen SAC will become a reduced carbon source/part carbon sink following implementation of the FRP will result in revegetation of bare peat areas and improvement in hydrology via drain blocking.

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

1.3 Legislative Context

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

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

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, hereafter referred to as the Habitats Directive.

- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended, hereafter referred to as the Birds and Habitats Regulations.
- Regulation (EU) 2024/1991 of the European Parliament and of the Council of June 2024 on nature restoration and amending Regulation (EU) 2022/869.
- 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.
- 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 Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

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

The EU Nature Restoration Regulation aims to restore damaged ecosystems and improve biodiversity with particular focus on capturing and storing carbon and reducing the impact of natural disasters. Specific targets include improving and re-establishing biodiverse habitats on a large scale and 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.

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.

1.4 Outline of this FRP document

- Section 2 of this FRP report outlines details of Ballymore Fen SAC and the conservation objectives for 7140 Transition mire habitat.

- Section 3 outlines the findings from the land and water desktop and site monitoring surveys that were carried out to inform the development of 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 Ballymore Fen

Ballymore Fen SAC is located 17 km north-west of Mullingar, County Westmeath. Ground elevations across the site range between approximately 90 m OD and 117 m OD. The fen is located at the lowest point within the local topography, at approximately 90 m, with surrounding areas characterised by gently elevated terrain in the order of 95–96 m, rising to higher ground at approximately 117 m. Land use on the surrounding hillslopes is agricultural.

The site is designated as an SAC due to the presence of 7140 Transition mires as listed on Annex I/II of the E.U Habitats Directive.

Figure 2-1 outlines the location and extent of Ballymore Fen SAC.

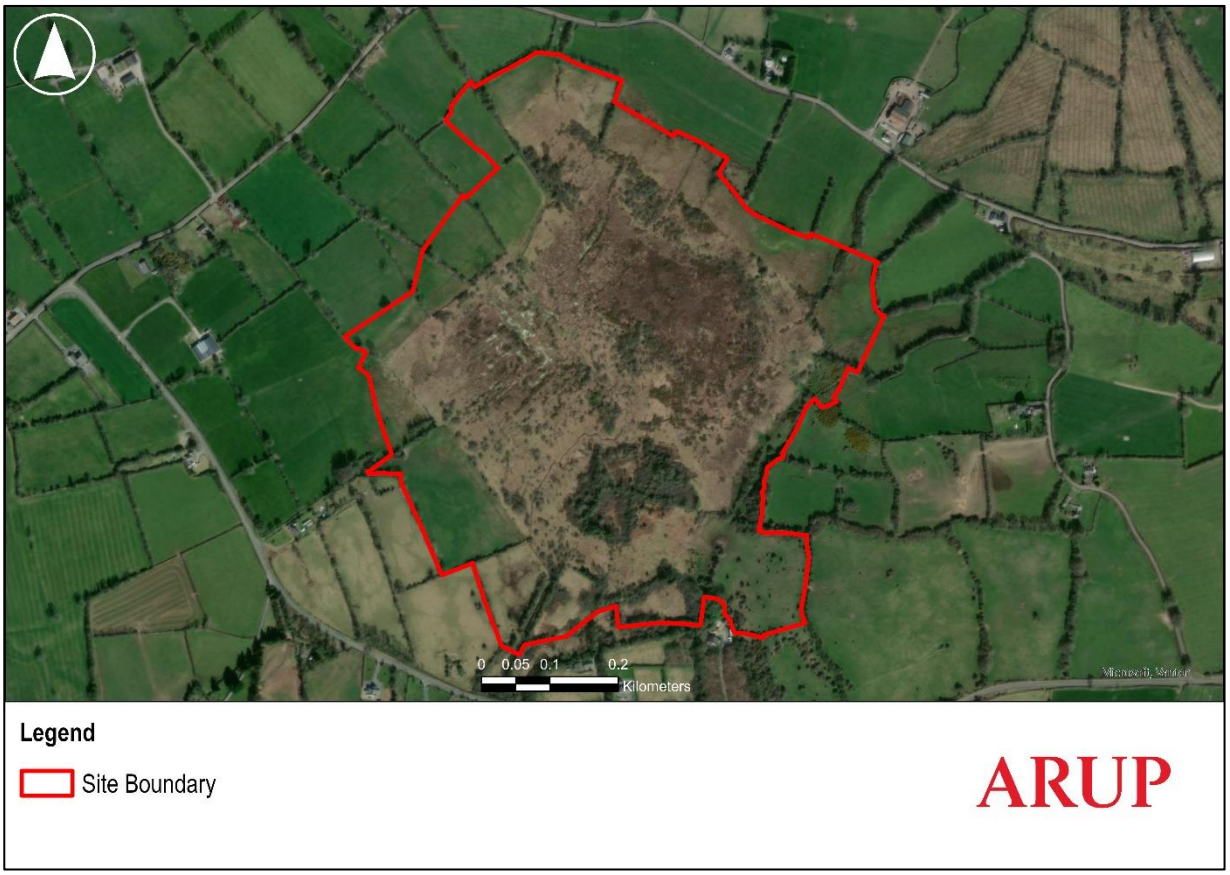


Figure 2-1: Site location map

The site synopsis (NPWS, 2014) for Ballymore Fen SAC notes the floating vegetation within the 7140 Transition mire has well developed scraw with bogbean (*Menyanthes trifoliata*), water horsetail (*Equisetum fluviatile*), marsh helleborine (*Epipactis palustris*) and diverse sedges (*Carex* spp.), and grading into *Schoenus*-rich fen that supports the protected Red Data Book species round-leaved wintergreen (*Pyrola rotundifolia*); the site also contains species-rich calcareous grassland on its slopes and supports notable fauna including 10-spined stickleback (*Pungitius pungitius*), smooth newt (*Lissotriton vulgaris*), common frog (*Rana temporaria*), and

several dragonfly and damselfly species, with historical turf-cutting but ongoing natural regeneration.

2.2 Fen Condition Assessment

Ballymore Fen was surveyed as part of the National Fen Survey (NFS) (Brophy, In prep) on the 22-23rd of June 2023. During the NFS, as detailed in Table 2-1, the following three pressures have been reported across the site in the reference:

- I02 Other invasive alien species (other than species of Union concern)
- I03 Problematic native species; and
- L02 Drainage.

Table 2-1: Assessment of impacts of pressures on 7140 Transition mire at Ballymore Fen SAC

Pressure Code	Pressure [sub-category]	Influence
I02	Other invasive alien species in the presence of rhododendron ponticum, affecting the 7140 habitat	Negative
I03	Problematic native species in the form of scrub affecting the 7140 transition mire habitat and the Annex I quality alkaline fen habitats.	Negative
L02	Drainage	Negative

The results of a field evaluation (2026) of the above pressures to inform the restoration planning process is detailed in Section 5 of this report.

Ballymore Fen SAC was surveyed as part of the National Fen Survey in 2023 (Brophy, In prep). The overall conservation status of 7140 Transition mires and the recorded Annex I quality 7230 Alkaline fens were assessed as Unfavourable – Bad. The results of the conservation status assessment of both habitats were carried out as part of the National Fen Survey at Ballymore Fen is summarised in Table 2-2.

Table 2-2: Conservation Status Assessment of 7140 Transition mire and Annex I quality 7230 Alkaline Fen

Annex I habitat	Area	Overall Status	Rationale
7140	Favourable	Unfavourable-Bad	Cover of negative indicator species, Cover of scattered native trees/shrubs

7230	Favourable	Unfavourable-Bad	Cover of positive indicator species, Cover of negative indicator species, Cover of scattered native trees/shrubs

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.

A conservation objective has been set for Ballymore Fen SAC for 7140 Transition mires, using attributes and targets based on parameters set out in the Habitats Directive. The restoration actions outlined by this restoration plan aim to contribute towards achieving these targets.

Ballymore Fen SAC is designated for 7140 Transition mires, which has the conservation objective 'to maintain the favourable conservation condition of Transition mires and quaking bogs at Ballymore Fen SAC'.

This document does not present the full suite of attributes, targets, and measures for the Annex I habitats. The selection provided in Table 2-3 reflects a conscious decision to focus on those with clear, direct benefits from the FRP measures. While these are listed below, it is anticipated that the remaining attributes, targets, and measures will also experience positive outcomes as restoration measures are implemented.

Table 2-3: Attributes and Targets for 7140 Transition mires (NPWS, 2019)

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	Yes. FRP actions are anticipated to sustain the current area of habitat designated within the SAC.
Habitat distribution	Occurrence	No decline, subject to natural processes	Yes	Yes. FRP actions will not result in a decline in distribution of wetland habitat within the SAC as actions are set to improve the condition.

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
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.
Ecosystem function: hydrology - water levels	Centimetres; duration of water levels	Maintain appropriate water levels necessary to support the natural structure and functioning of the habitat	Yes	Yes. FRP actions include water level monitoring to assess if drain blocking is required to improve or maintain the hydrology of 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 drain blocking is required to improve or maintain the hydrology of 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 both water level monitoring and ecological monitoring, to assess the overall condition of the wetland habitats present on site. Subsequent actions informed by this data may include measures to remove invasive and problematic species and encourage wetter condition which in itself will contribute to positive vegetation composition.
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Yes	
Vegetation composition: typical vascular plants and bryophytes	Percentage cover at a representative number of 2 m x 2 m monitoring stops	Maintain adequate cover of typical vascular plant and bryophyte species	Yes	
Vegetation composition: native negative indicator species	Percentage cover at a representative number of 2 m x 2 m monitoring stops	Native negative indicator species at insignificant levels	Yes	

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2 m x 2 m 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 2 m x 2 m 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	

3 Land and Water

3.1 Desk Study

3.1.1 Meteorological Conditions

Understanding long-term meteorological patterns is key for informing effective fen restoration planning, particularly with respect to hydrological dynamics. To support this, historical precipitation data over the past 50-years from the closest Met Éireann weather station, Athlone (Glynnwood), have been reviewed to assess seasonal variability in rainfall at the site and surrounding areas (Met Éireann, 2025).

Weather station dataset of Athlone (Glynnwood) has been visualised: average monthly precipitation (mm), incorporating a -year period to show seasonal distribution patterns. 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 in Figure 3-1.

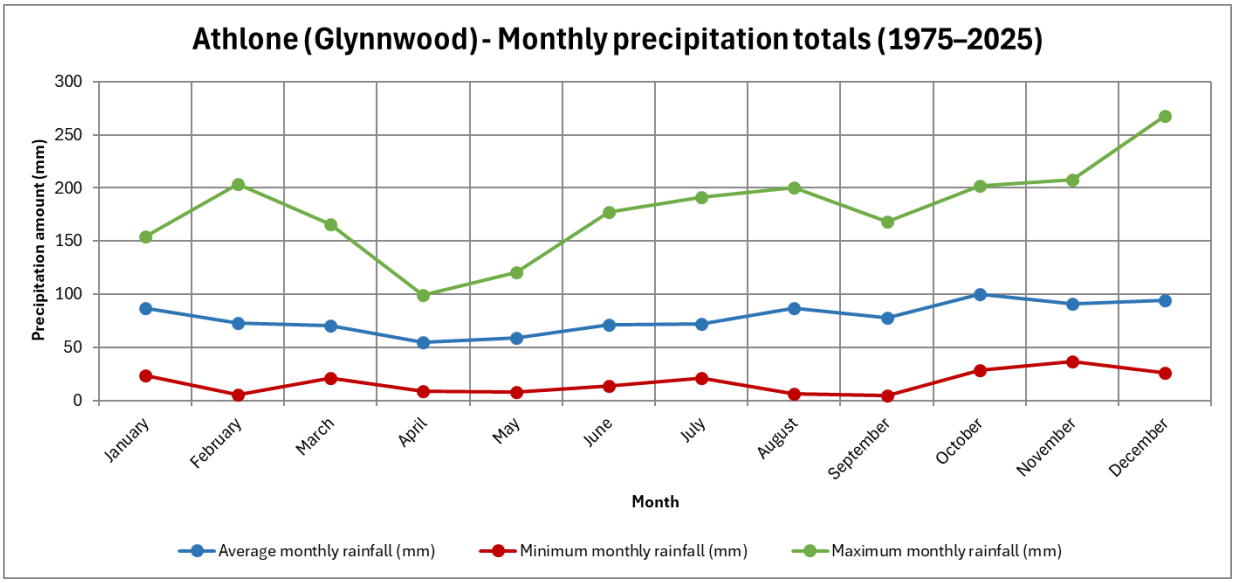


Figure 3-1: Athlone (Glynnwood) OPW weather Station – Total annual precipitation within the last 30 years (1975-2025)

According to studies by Bijkerk (2023) the fen peat holds onto water, leading to a delay of groundwater levels dropping after a drought period – the fen will keep losing water until it in equilibrium with its surrounding catchments. Water is held for a longer time in fen peat due to capillary forces than in the soil in fields surrounding the fen. After a sustained drought, ground water levels in the fen do not fall as quickly as surrounding non peat land.

When evapotranspiration is high, meaning more water is being lost to plant uptake and evaporation, discharge at the Ballymore outlet to the south is low. In contrast, when

evapotranspiration is low, particularly during wetter and cooler periods, discharge increases, with clear peaks following rainfall. This indicates that evapotranspiration strongly influences how much water reaches the southern outlet.

The discharge and total evapotranspiration of the is represented in Figure 3-2.

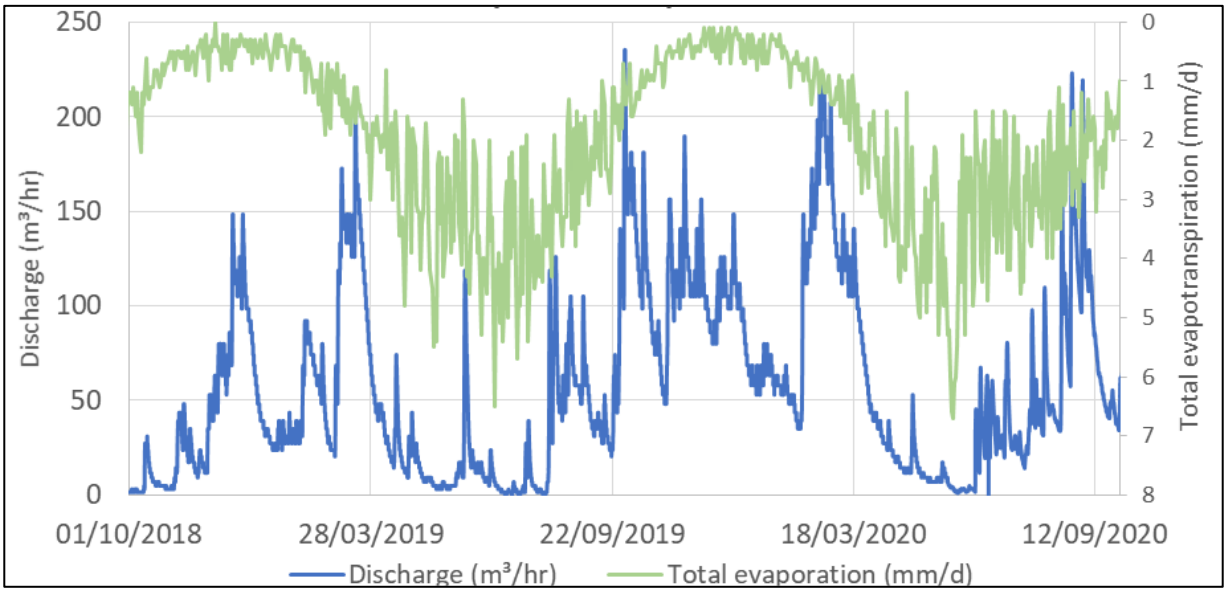


Figure 3-2: Ballymore fen southern outlet hydrograph and actual evapotranspiration between October 1st 2018 and September 30th 2020, (Bijkerk,2023).

3.1.2 Hydrogeological Setting

The site is underlain by the Waulsortian limestones Formation which consists mainly of pale grey biomicrite and is characterised by massive, fine-grained micritic limestone, deposited as carbonate mud mounds in a low-energy, deep marine environment. The formation is typically poorly bedded, fossil-poor, and structurally competent, but is commonly karstified, resulting in enhanced secondary permeability and locally complex groundwater flow conditions. The bedrock geology of the site is presented in Figure 3-3.

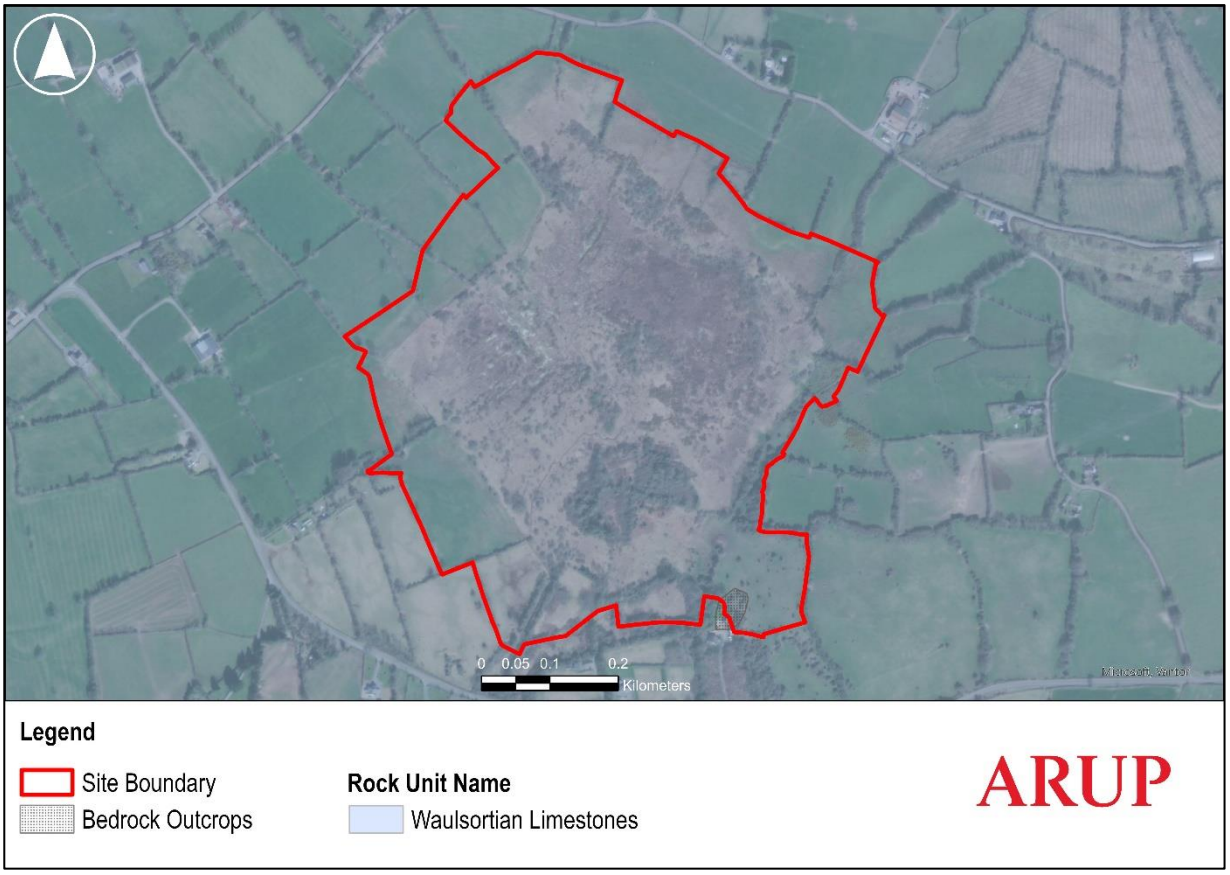


Figure 3-3: Bedrock Geology of Ballymore Fen SAC (Geological Survey Ireland (GSI), 2025)

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. The aquifer classification underlaying the site is presented in Figure 3-4.

The Ballymore fen groundwater body, GWDTE-Ballymore Fen & Mire, which underlies the site is at 'good' status and is 'not at risk' of not achieving its WFD objectives.

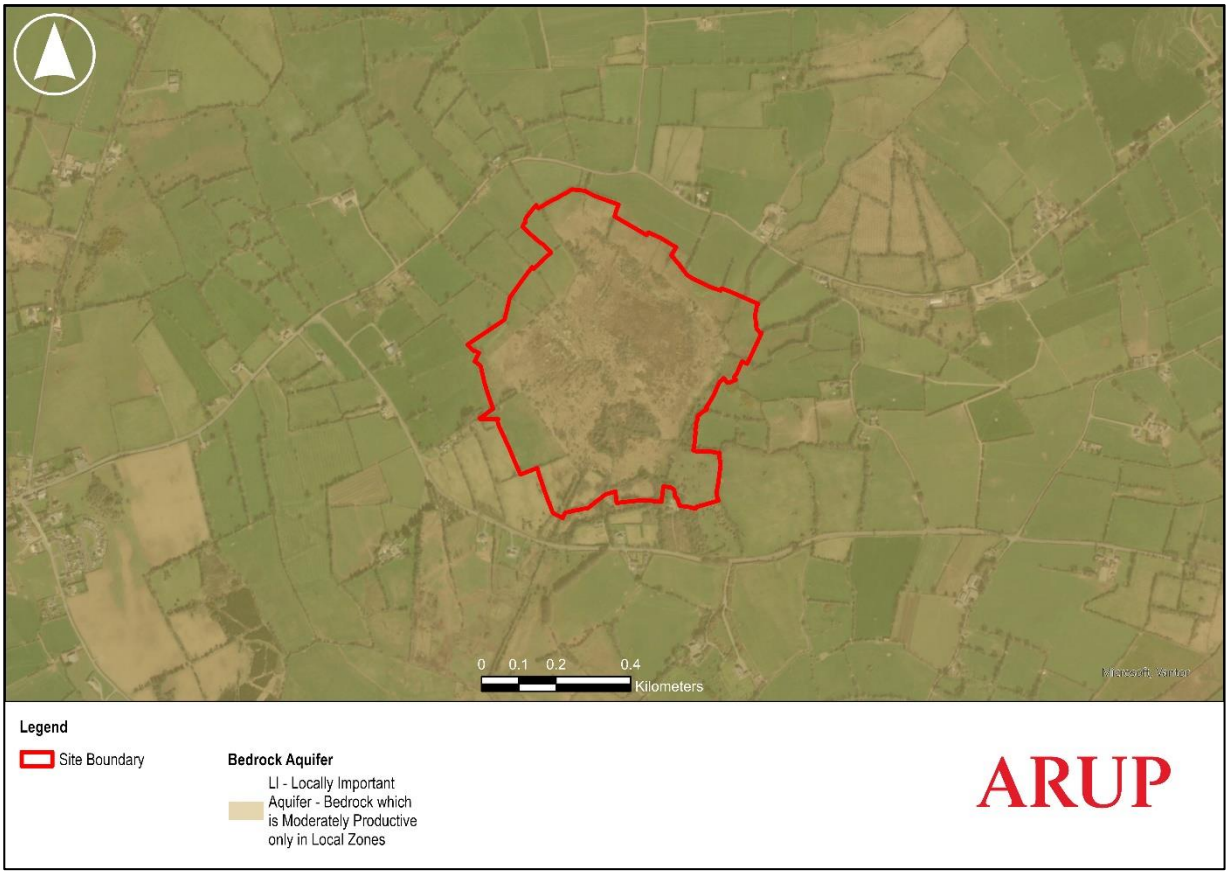


Figure 3-4: Aquifer classification and karst underlying Ballymore Fen (GSI, 2025)

Quaternary sediments within the site boundary comprise predominantly fen peat, with limestone-derived till present around the site perimeter and a localised bedrock outcrop to the south. The surrounding area is underlain mainly by limestone-derived till, with interspersed areas of fen peat, alluvium, and lacustrine sediments.

To the south of the site, alluvial deposits are present, transitioning into fen peat and lacustrine sediments, while to the north the subsoils comprise gravels derived from limestones, with associated areas of fen peat and lacustrine sediments. The gravel deposits predate the peat, having formed during glacial deposition, whereas the peat accumulated during the post-glacial period. The subsoil types underlying the site are presented in Figure 3-5.

Soil type in Ballymore fen observed during the Scoping Study and Pilot Survey of Fens (O'Neill, 2023) included peat with depths ranging from 150 cm to more than 223 cm. The Teagasc soils map notes that soil types within is fen peat.

Groundwater vulnerability range is high, with an area of extreme vulnerability in the southeast where rock is near or at surface or karst is present. This pattern is reflected by the recharge rates in the 0 to 50 mm/year depending on local conditions. The groundwater vulnerability for the site is presented in Figure 3-6.

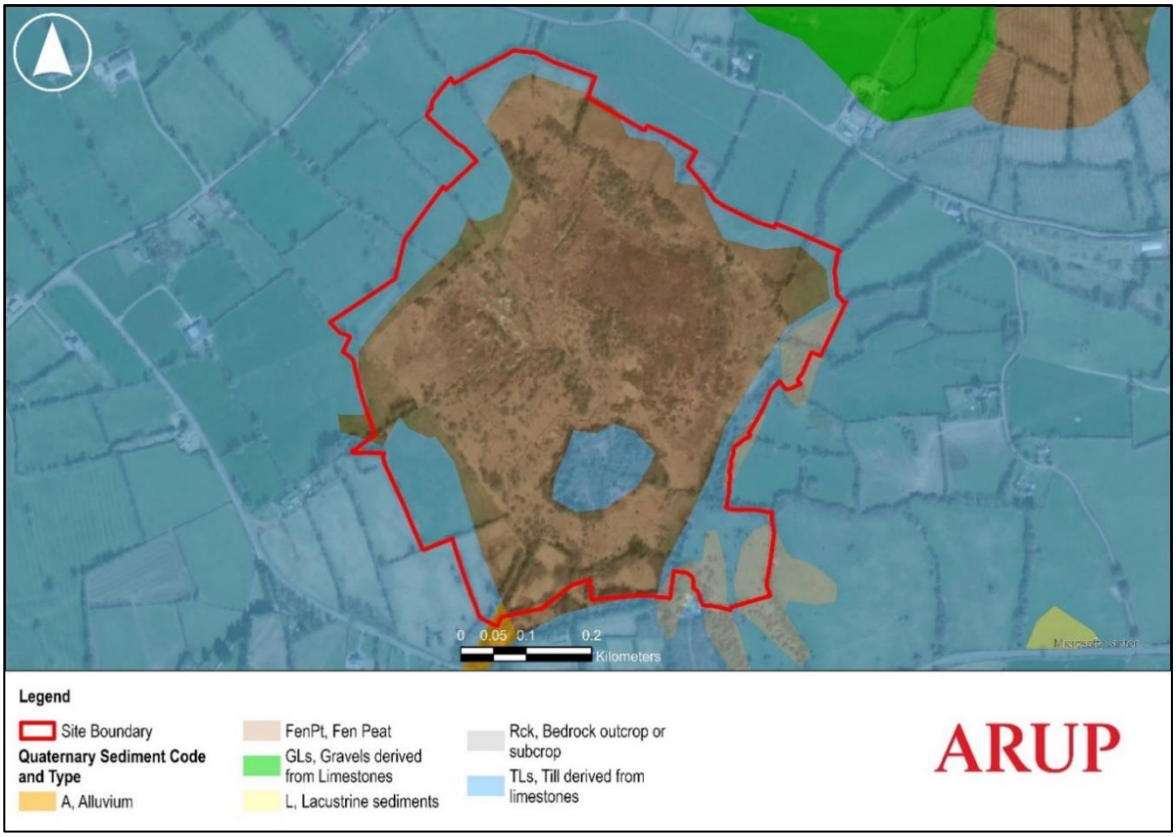


Figure 3-5: Sub-soil type underlying Ballymore Fen SAC (Source: GSI, 2025)

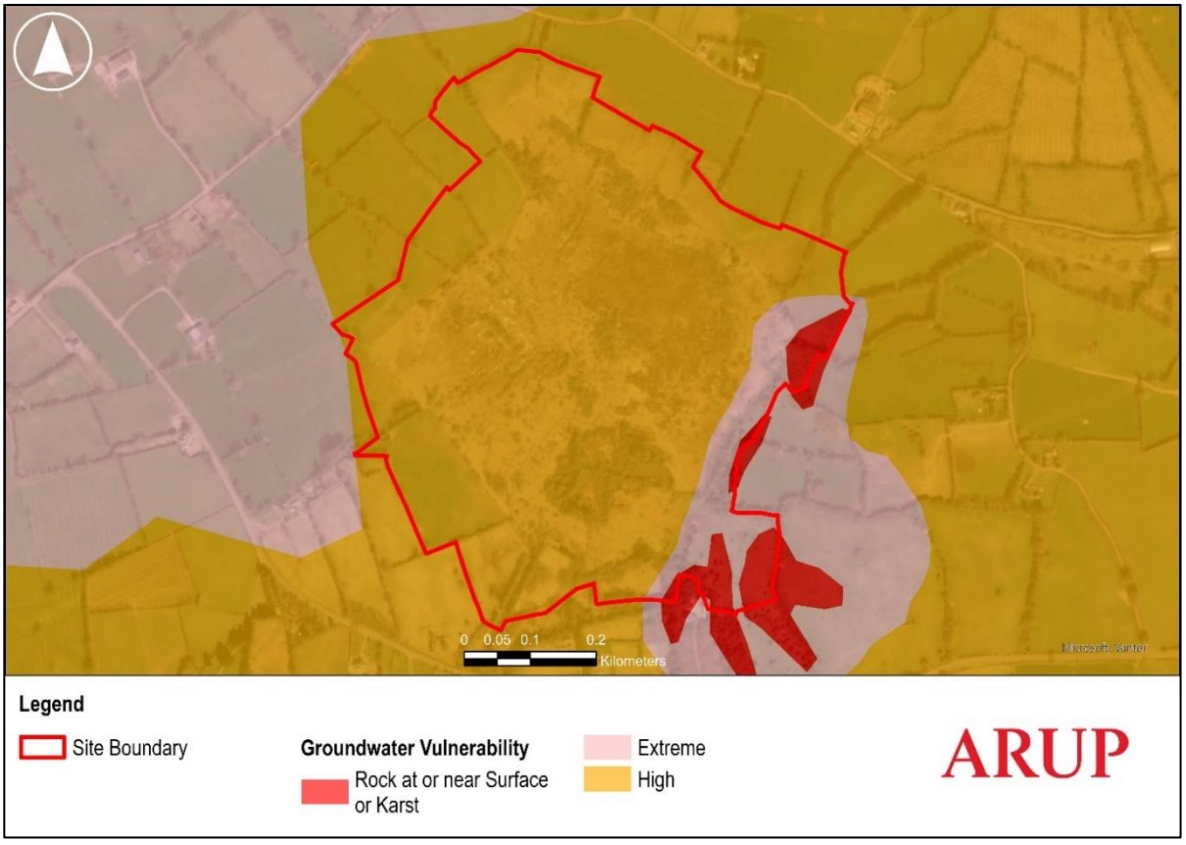


Figure 3-6: Groundwater vulnerability map for Ballymore Fen SAC (Source: GSI, 2025)

3.1.3 Topographic and Surface Water Drainage

Ballymore fen SAC is located within the Upper Shannon Catchment and is primarily drained by tributaries of the Rath River at the north and at the south by Mullenmeehan Stream. The fen is situated within the Upper Shannon Catchment 26F, with most of the site being located on the headwaters of the Inny [Shannon]_SC_070 sub-catchment and the Inny [Shannon]_SC_090 sub catchment (Figure 3-7). In the south of the site, the Water Framework Directive (WFD) River Sub-Basin: MULLENMEEHAN STREAM_10 drains the southern portion of the site to the north-west towards Lough Ree which drains to Lough Derg, then to the Limerick Dock, onto the Shannon estuary. In the north of the site, the WFD River Sub-Basin: RATH_020 drains the Northern portion of the site to the north-west towards Lough Ree.

The Rath_020 WFD River waterbody, is in a 'moderate' status and 'at risk' of not achieving its WFD objectives (EPA, 2025). This is due to the waterbody having a moderate Q-value. The MULLENMEEHAN STREAM_010 River WFD waterbody is classed at 'poor' WFD Status and 'at risk' of not achieving its WFD objective to reach a 'good' status by 2027. This is due to the waterbody having a poor Q-value. The groundwater body (GWB) underlying Ballymore fen SAC is the GWDTE-Ballymore Fen & Mire (SAC002313). The GWB has a 'good' status and is 'at risk' of failing to achieve its WFD objectives (EPA, 2025). This is due to the GWB having a poor quantitative status.

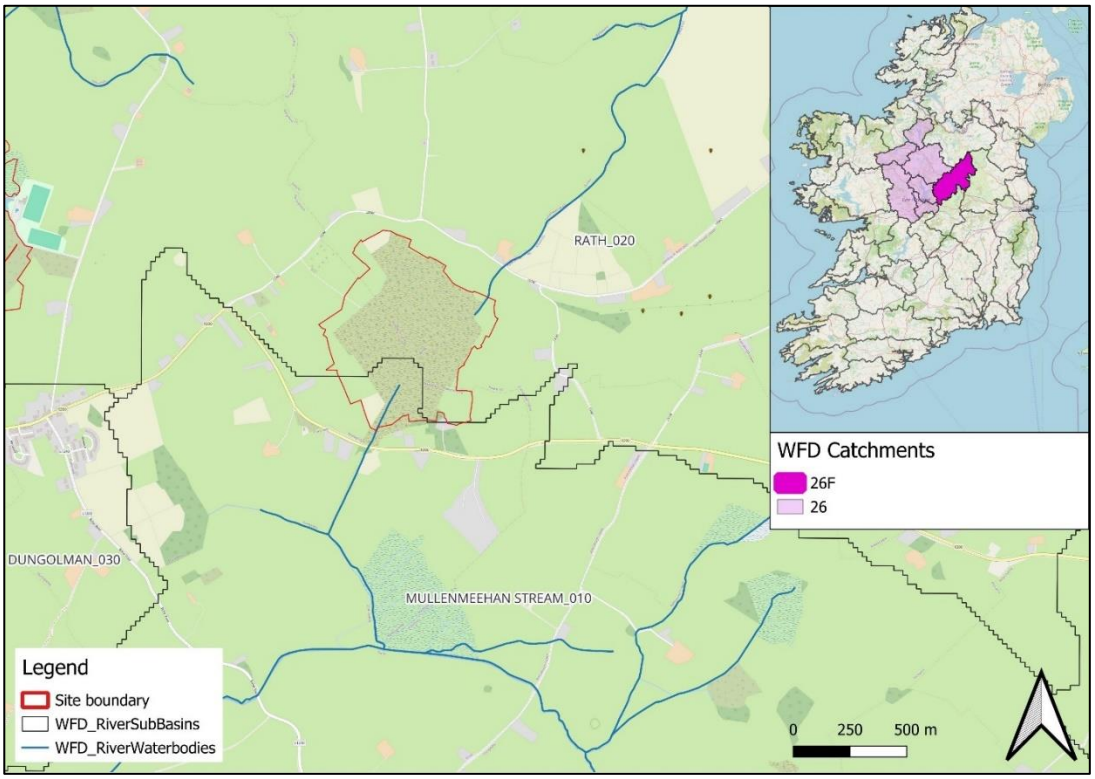


Figure 3-7: WFD Catchment and River sub-basin (EPA, 2025)

The site is positioned at approximately 90m OD and is within a depression with higher ground on surrounding hillslopes (

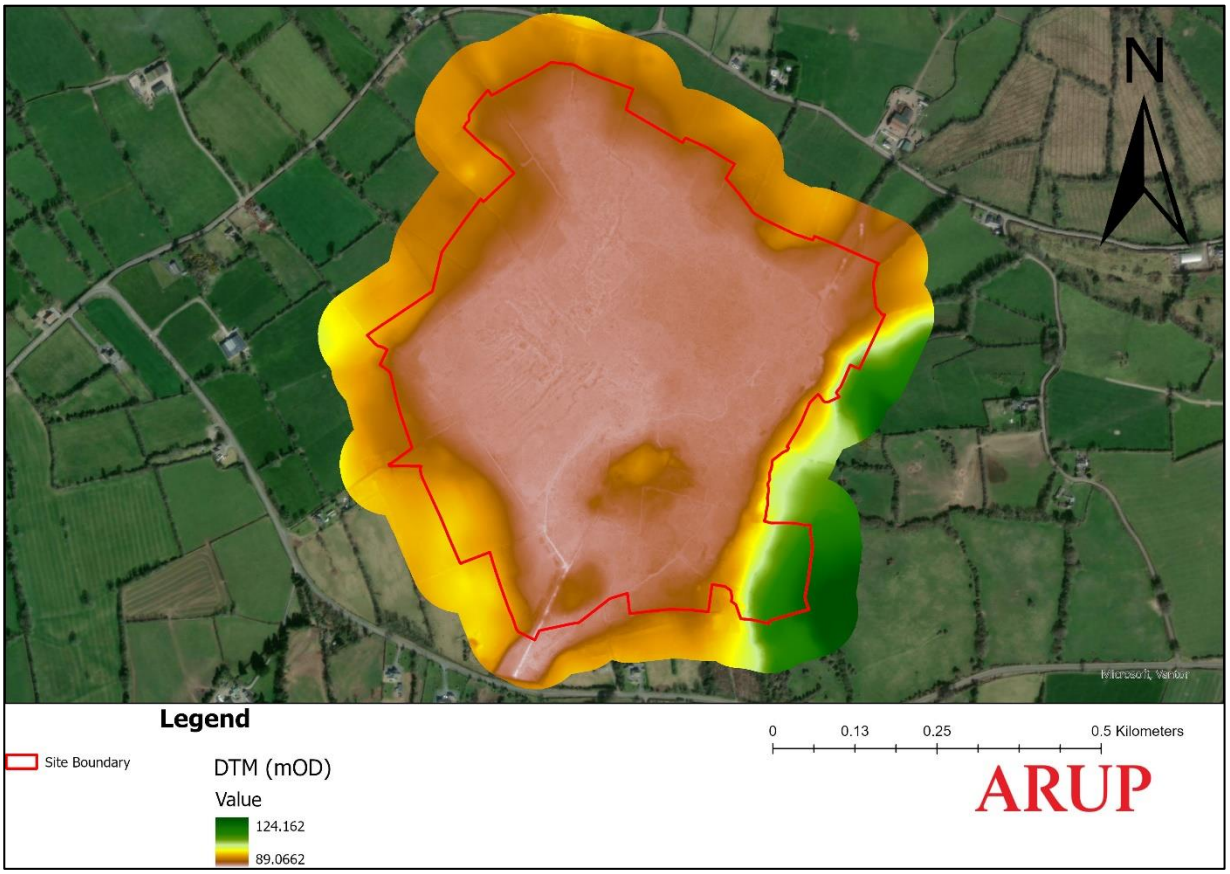


Figure 3-8). The site is relatively flat within the centre, although there is a raised 'island' to the south. Past peat cutting to the north has led to development of extensive fen pools in the north-west of the site. Agricultural farms extend to the edge of the slope, up until there is a change

in elevation (

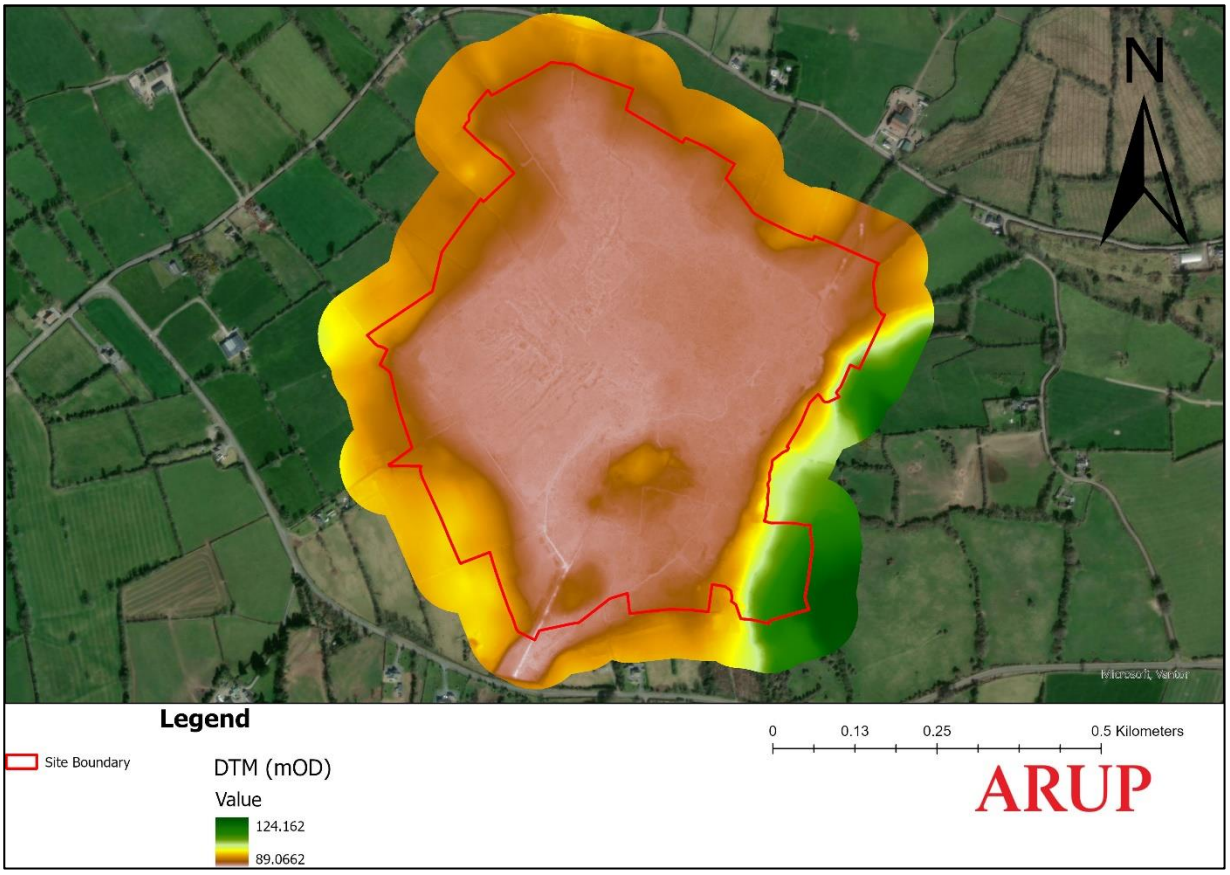


Figure 3-8 and Figure 3-9).

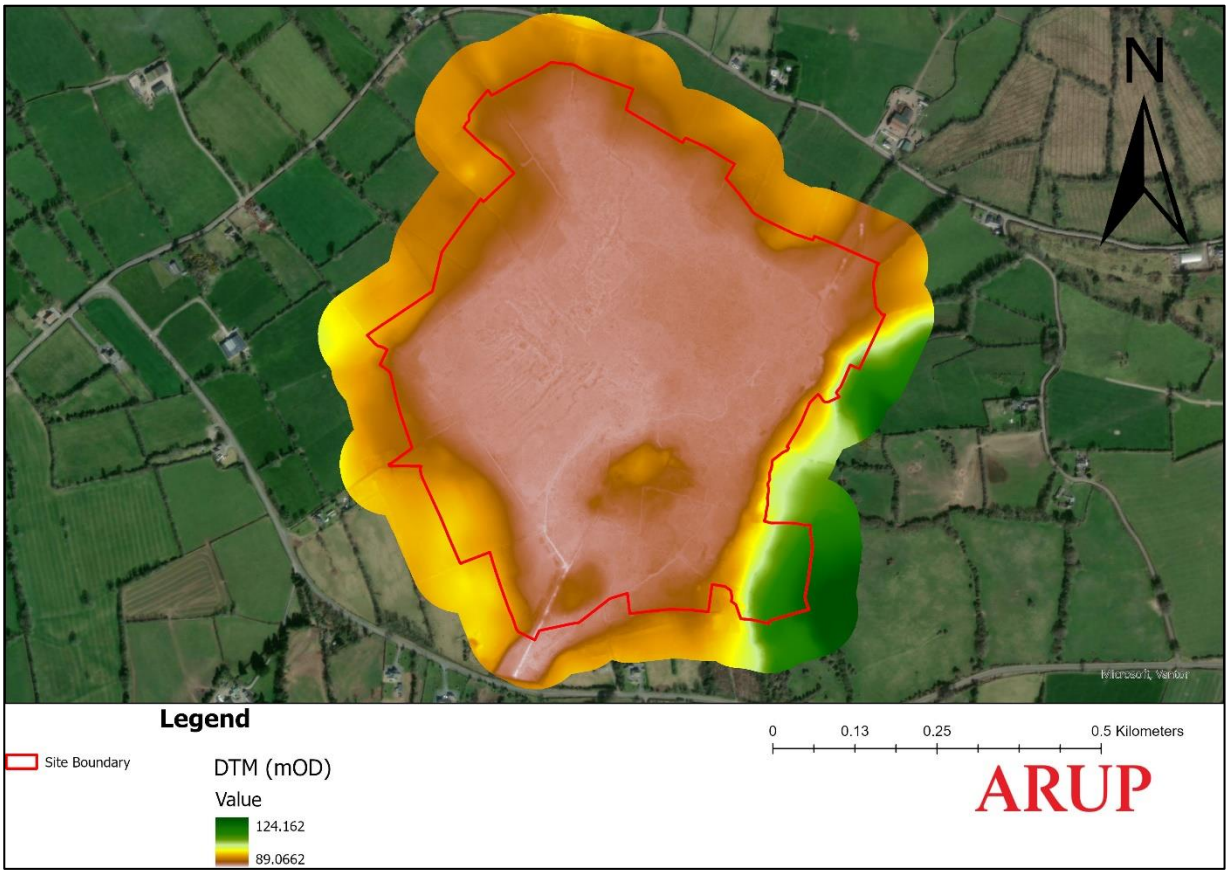


Figure 3-8: Digital terrain model (DTM) of Ballymore Fen SAC

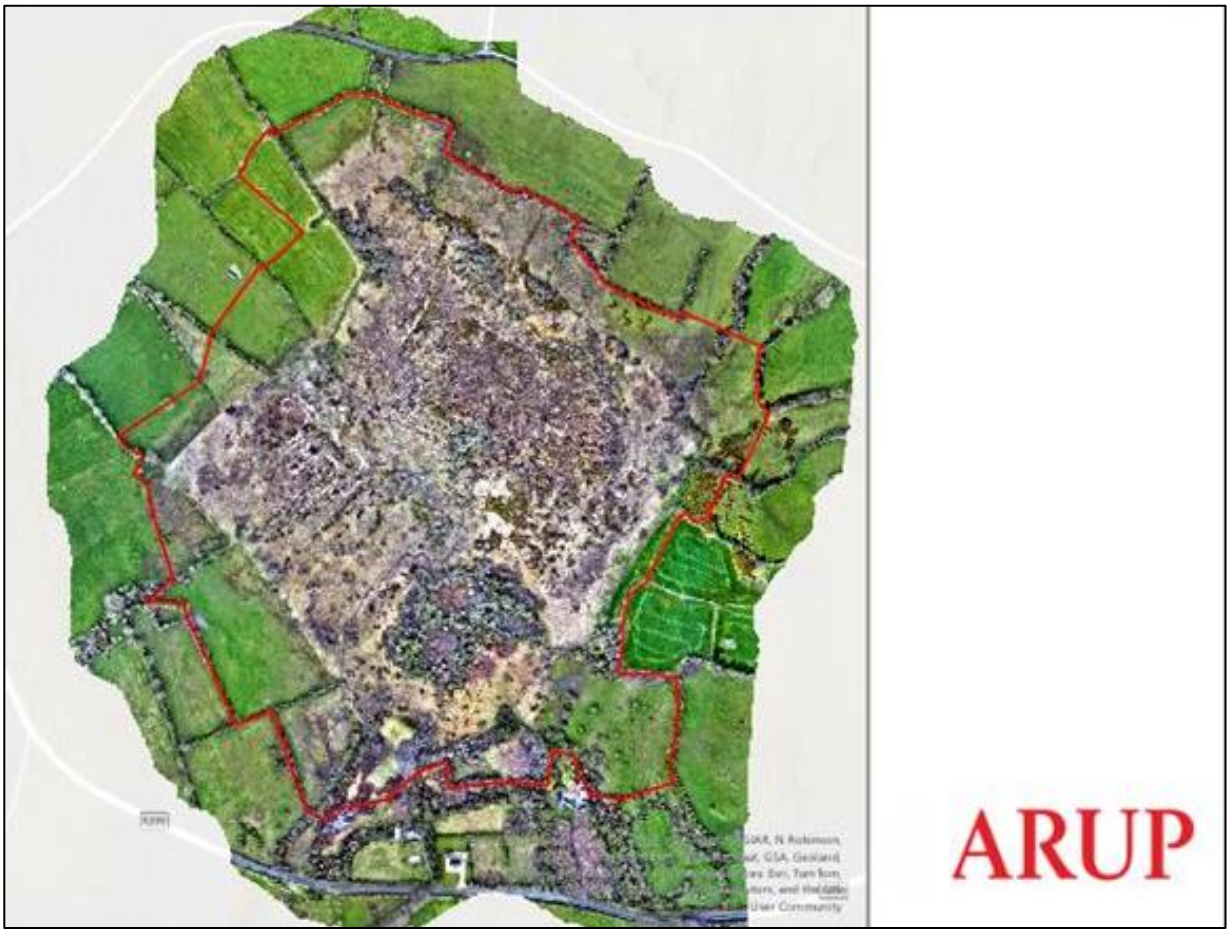


Figure 3-9: Orthophoto of Ballymore Fen SAC

Groundwater and surface water contours developed by Bijkerk (2023) shown in Figure 3-10 and Figure 3-11. Seasonal variation in surface water flow is evident within the fen. In winter, surface water flows from the north-west and east towards the fen's natural stream, discharging to the OPW drain to the south (Figure 3-11). In summer, the lowest water levels occur in the central area of the fen to the north-east of the stream, with flow directed towards the south-eastern boundary; however, field observations indicate that this flow reconnects with the natural stream via a small ditch (Figure 3-11). Overall, surface water levels show limited seasonal change, which may indicate resilience of the fen's hydrological regime (Bijkerk, 2023).

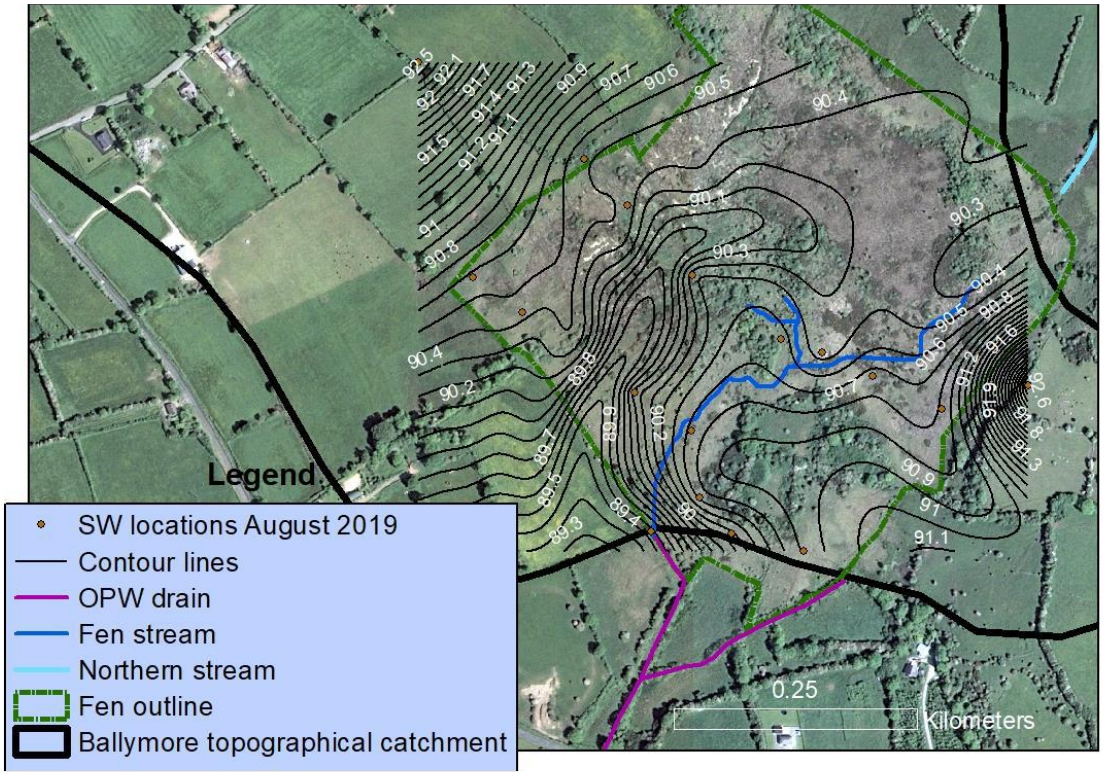


Figure 3-10: Contour lines of Ballymore fen surface water and surrounding groundwater catchment interpolated using point measurements in August 2019 (Bijkerk, 2023)

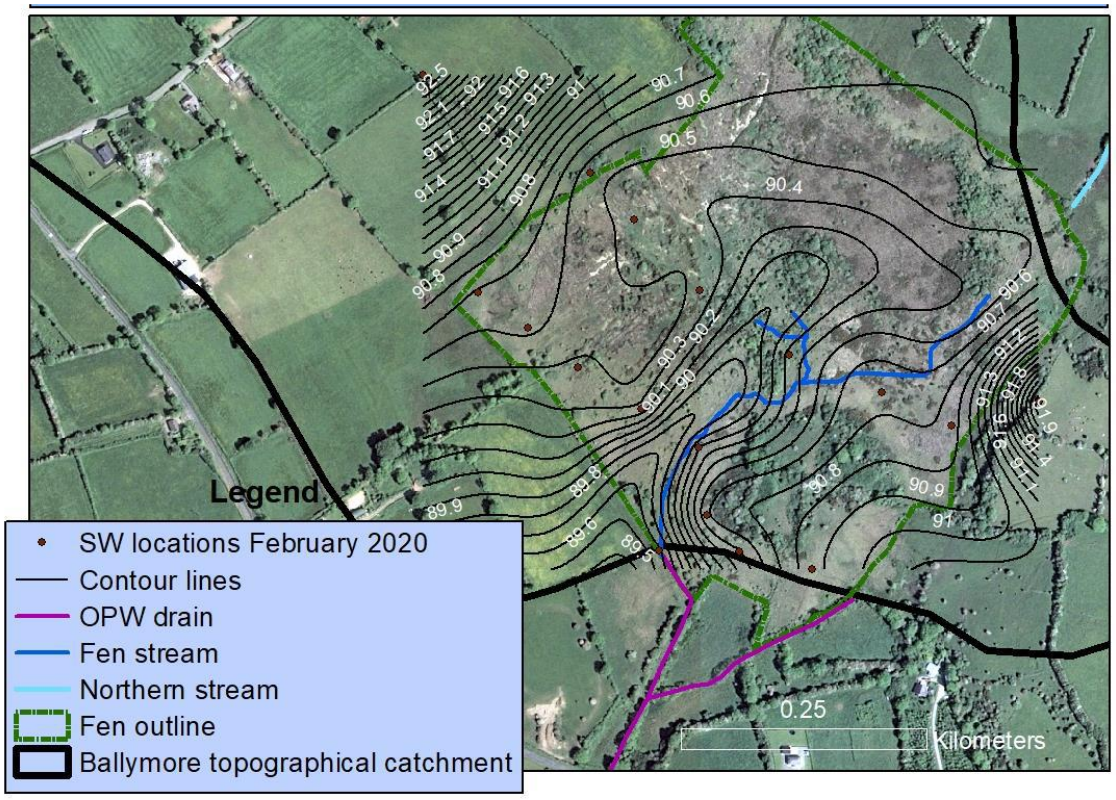


Figure 3-11: Contour lines of Ballymore fen surface water and surrounding groundwater catchment interpolated using point measurements in February 2020 (Bijkerk, 2023)

The topographical catchment area of Ballymore delineated by the highest points surrounding the fen is 0.88 km^2, while the fen area covers 0.23 km^2 (Figure 3-12).

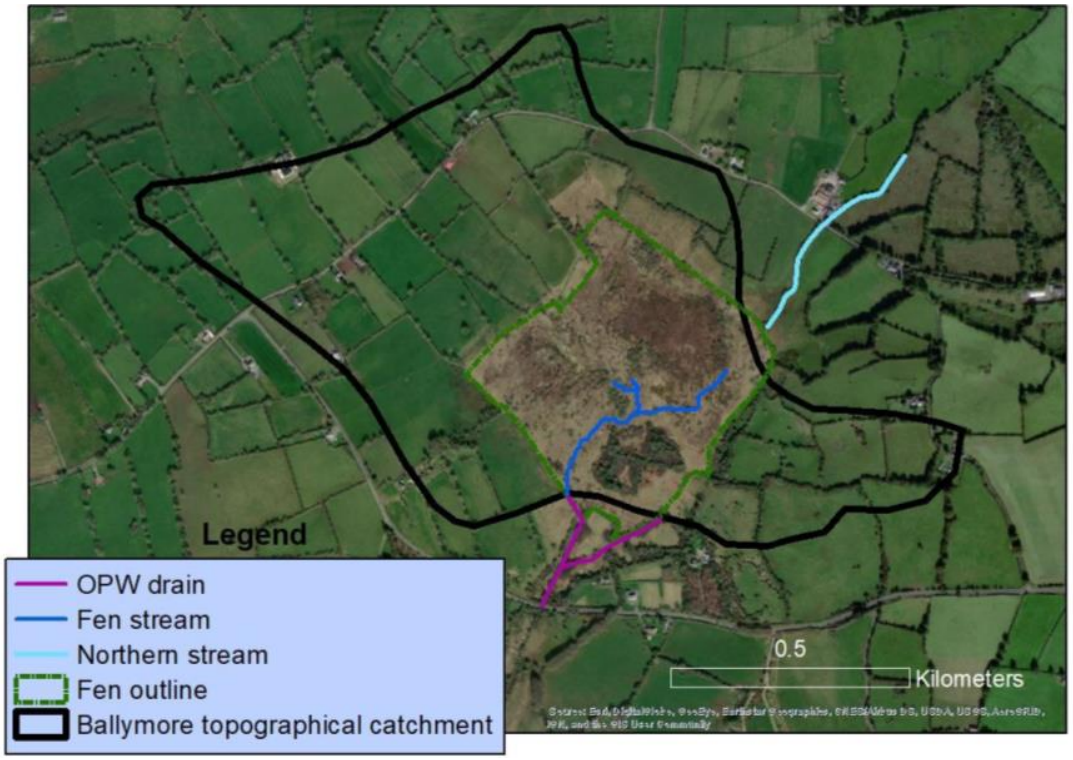


Figure 3-12: Topographic catchment area of Ballymore fen (Bijkerk, 2023)

An assessment of historical and current hydrological data indicates that the water regime of Ballymore Fen has changed over time, primarily due to drainage for peat extraction activities (Figure 3-13). Springs located at the west boundary of the site, feed the surface water drainage system. These springs can be seen in historical maps from the early-1800s (**Figure 3-14**).

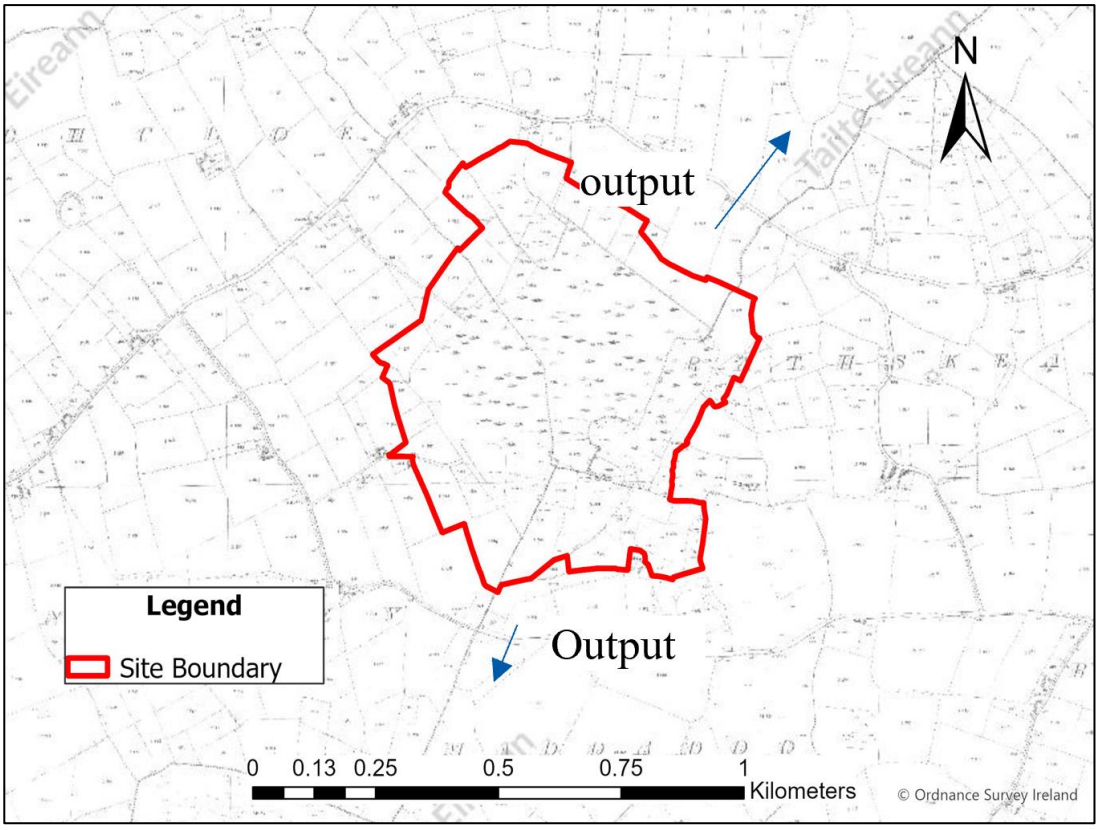


Figure 3-13: Historical water distribution and retention within wetland from1879-1913 (Tailte Éireann Historical mapping)

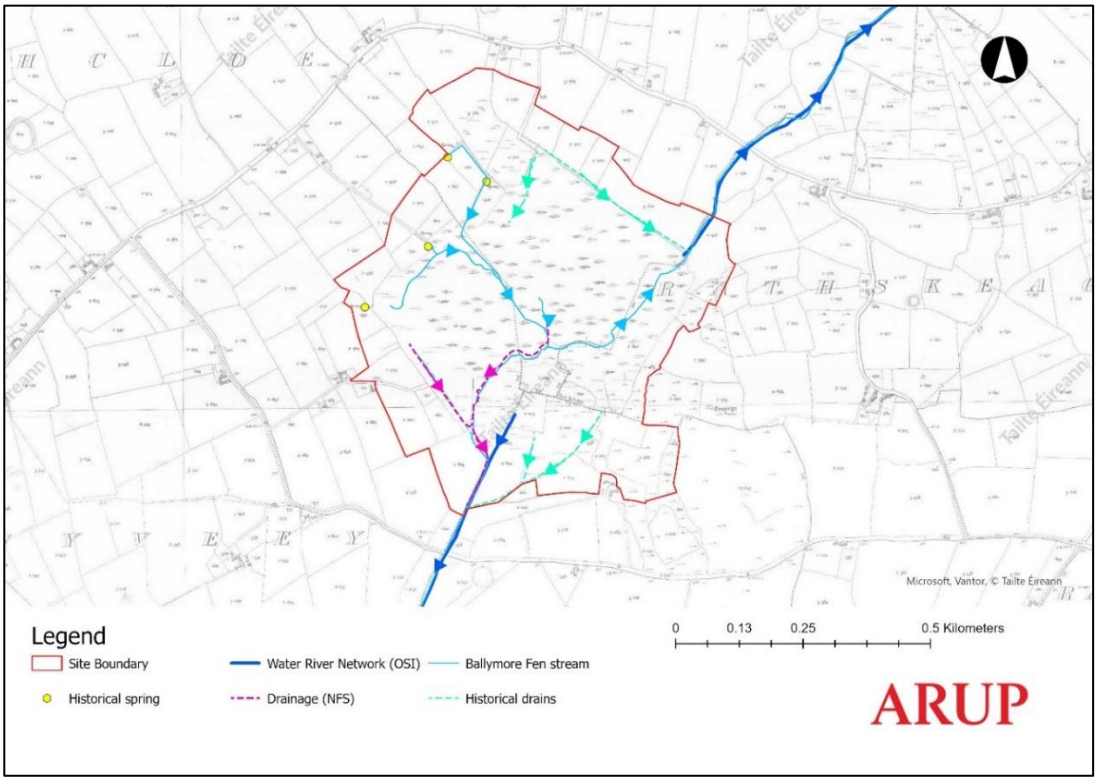


Figure 3-14 Historical water distribution and retention within with flow pathways within Ballymore Fen (Tailte Éireann Historical mapping)

The mapped Wetness Index[2] classifies the site as temporarily wet, indicating alternating periods of saturation and dryness over the period of 2012 to 2018. This pattern suggests a mosaic of variable soil moisture conditions, supporting intermittent wetland characteristics across the site (Figure 3-15). Total productivity mapping of Ballymore Fen further illustrates the site's hydrological variation (Figure 3-16Figure 3-16Figure 3-15). Most of the area is classified as having moderate productivity, typically associated with semi- degraded peatlands habitats impacted by drainage and vegetation encroachment. In contrast, the north section of the site shows low productivity, which is characteristic of relatively intact peatland. These areas exhibit nutrient-poor, water-saturated soils and are dominated by Sphagnum mosses, indicating a functioning peatland system.

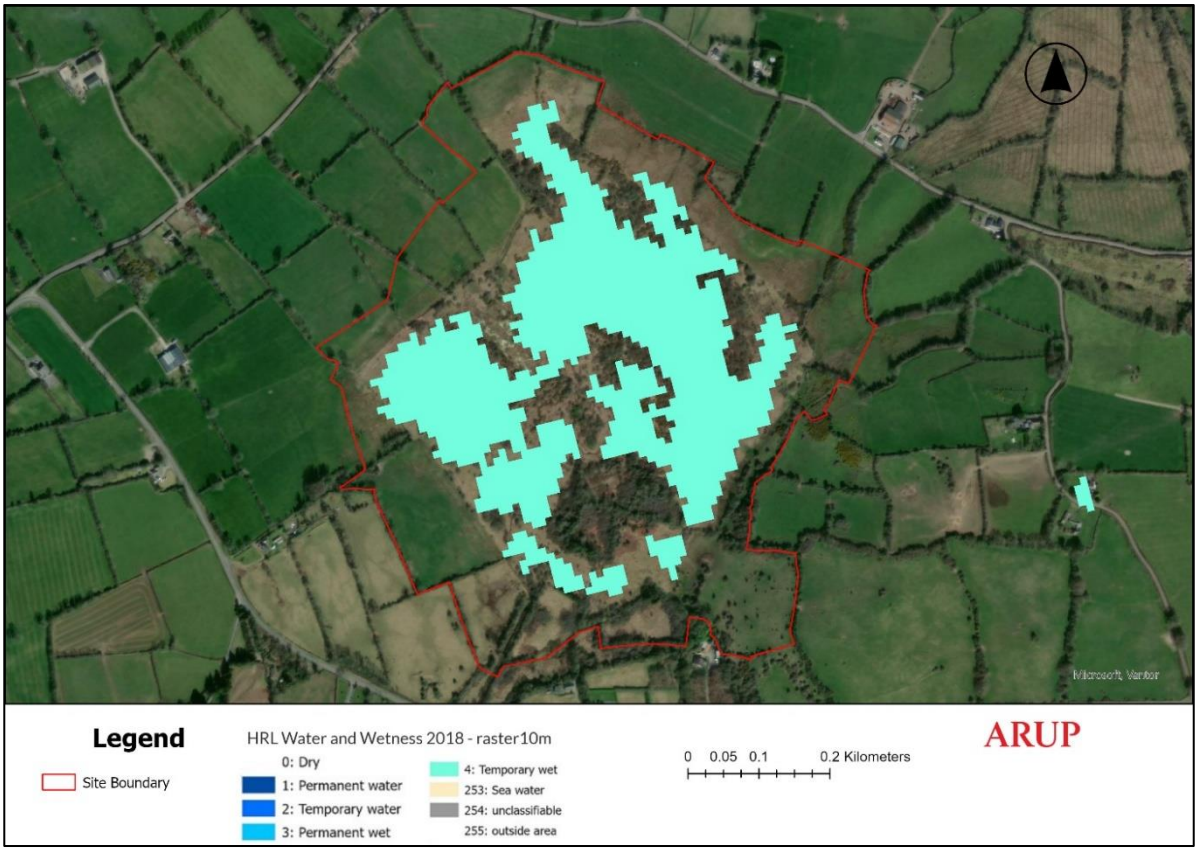


Figure 3-15: HRL Water and Wetness – 2018 of Ballymore Fen SAC (Copernicus, 2026)

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

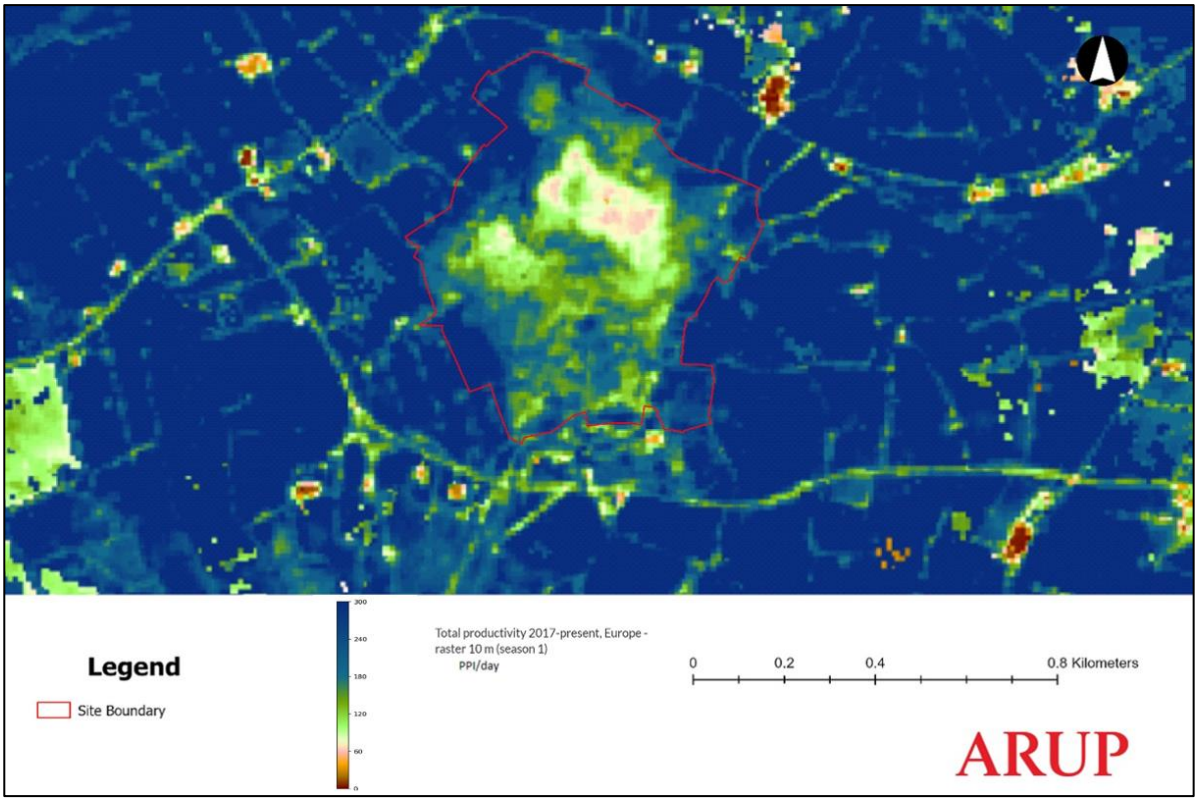


Figure 3-16: Total Productivity 2017 -present, Europe – raster 10 m (season 1) of Ballymore Fen SAC (Copernicus, 2026)

The main drainage feature in Ballymore Fen is the arterial drain to the south and the arterial drain to the north (Figure 3-17). There are historical drains to the south-east and south-west which both drain towards the arterial drain in the south. There may be drainage to the north directed towards the northern drain, but it is less active than the southern drain. The springs to the west also have natural drainage towards the more natural fen stream. The spring in the north-west has a more modified drain directing flow towards the fen stream.

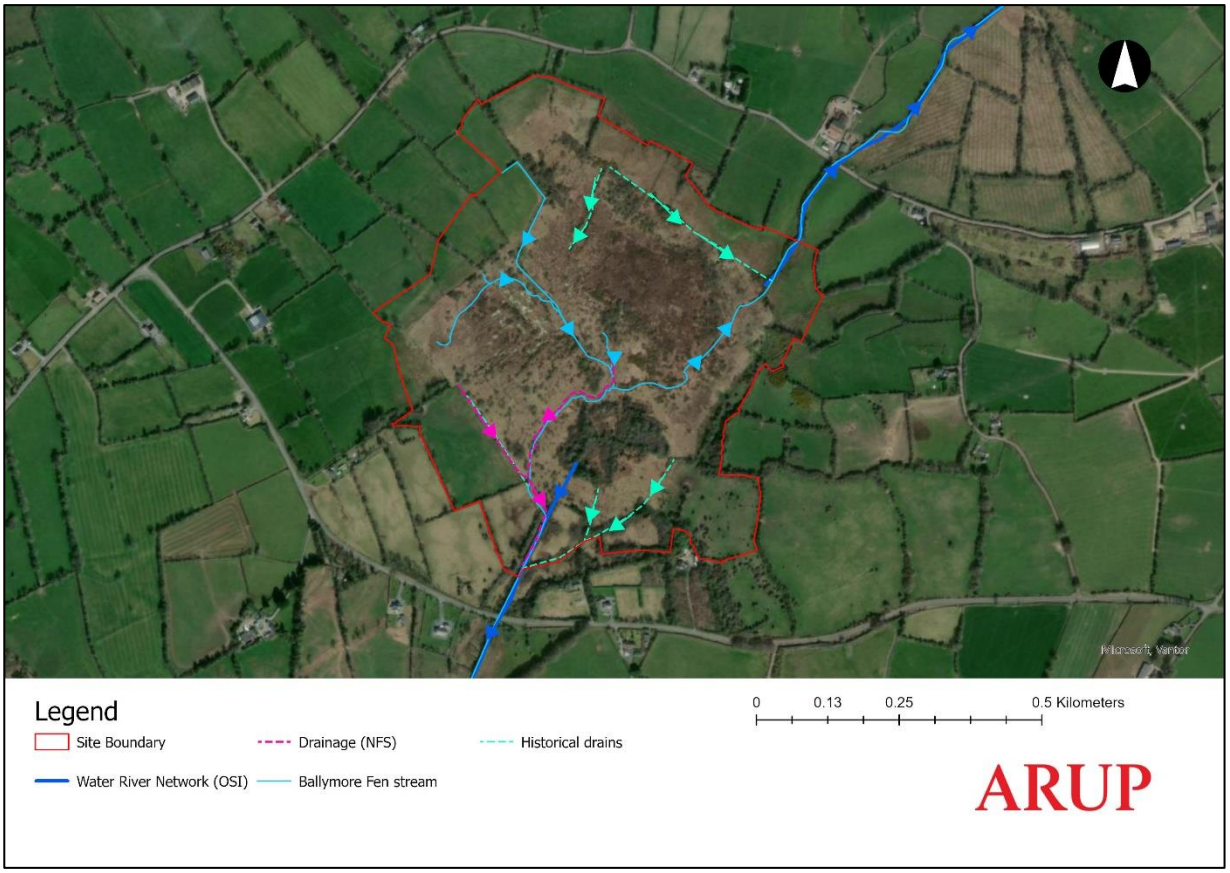


Figure 3-17: Mapped drainage network of Ballymore Fen SAC

3.1.4 Land use Pressures and Water Quality

Ballymore Fen SAC is a -water-dependent habitat with a conservation status linked to the achievement of water quality objectives under the River Basin Management Plan (RBMP) for Ireland (NPWS, 2024; DHLGH, 2024). The lead organisation leading targeted measures for the RBMP is LAWPRO. There are three associated waterbodies targeted under the RBMP, including the Rath WFD river waterbody. In addition, Targeting Agricultural Measures are needed in this catchment to restore water quality, with the area being classed as at risk of phosphorus and sediment losses (EPA, 2025). Other pressures include historical peat harvesting, for a few hundred years, which has ceased since 1988 according to a local farmer (Bijkerk,2023).

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 range from medium to high risk, with areas of higher risk particularly noted in the southwest and west (Figure 3-18). The borders of the site are classed as having a high to moderately high PIP

rank (Figure 3-19), with the northern border having the highest ranking. When connected to the central fen stream these areas may provide a pathway for high Phosphorus transfer.

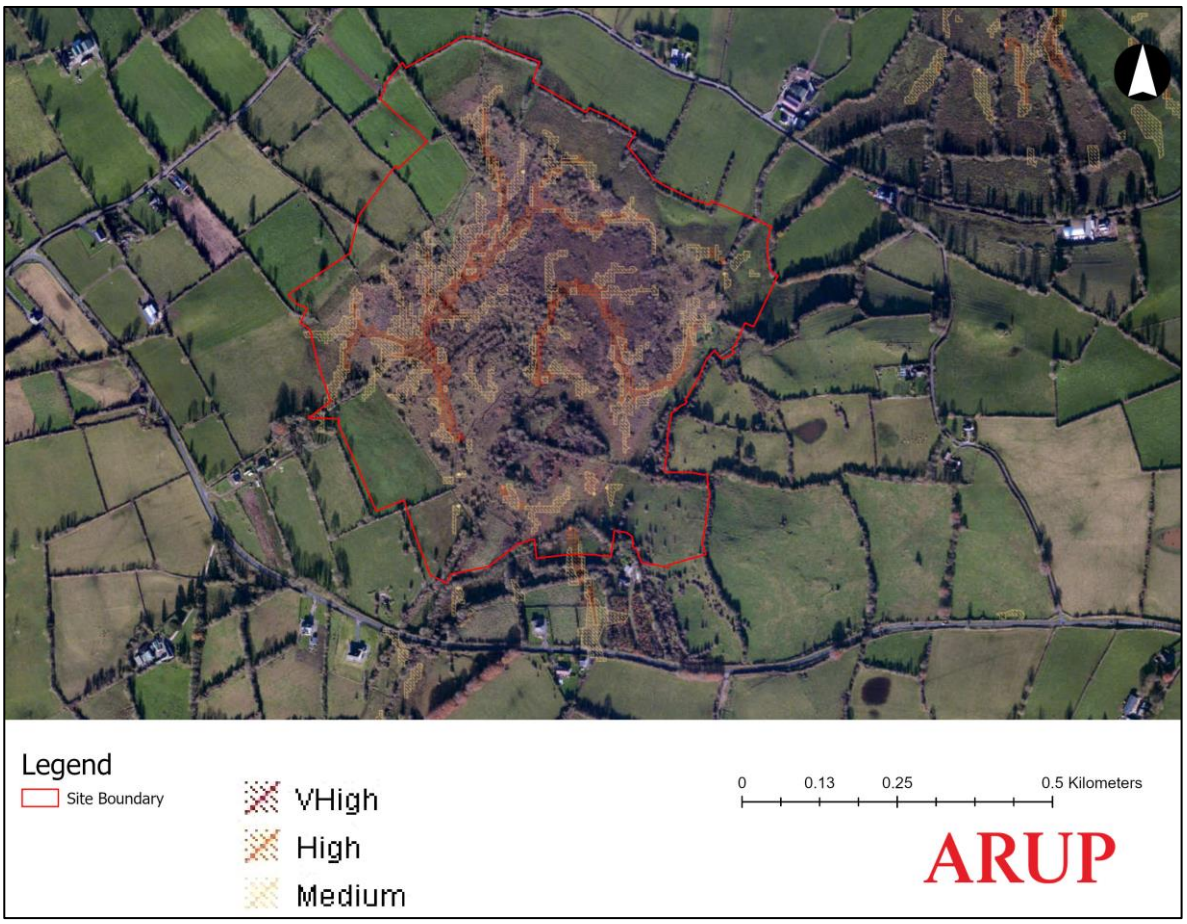


Figure 3-18: PIP- P - Flow delivery paths and points for Phosphorus (EPA, 2025)

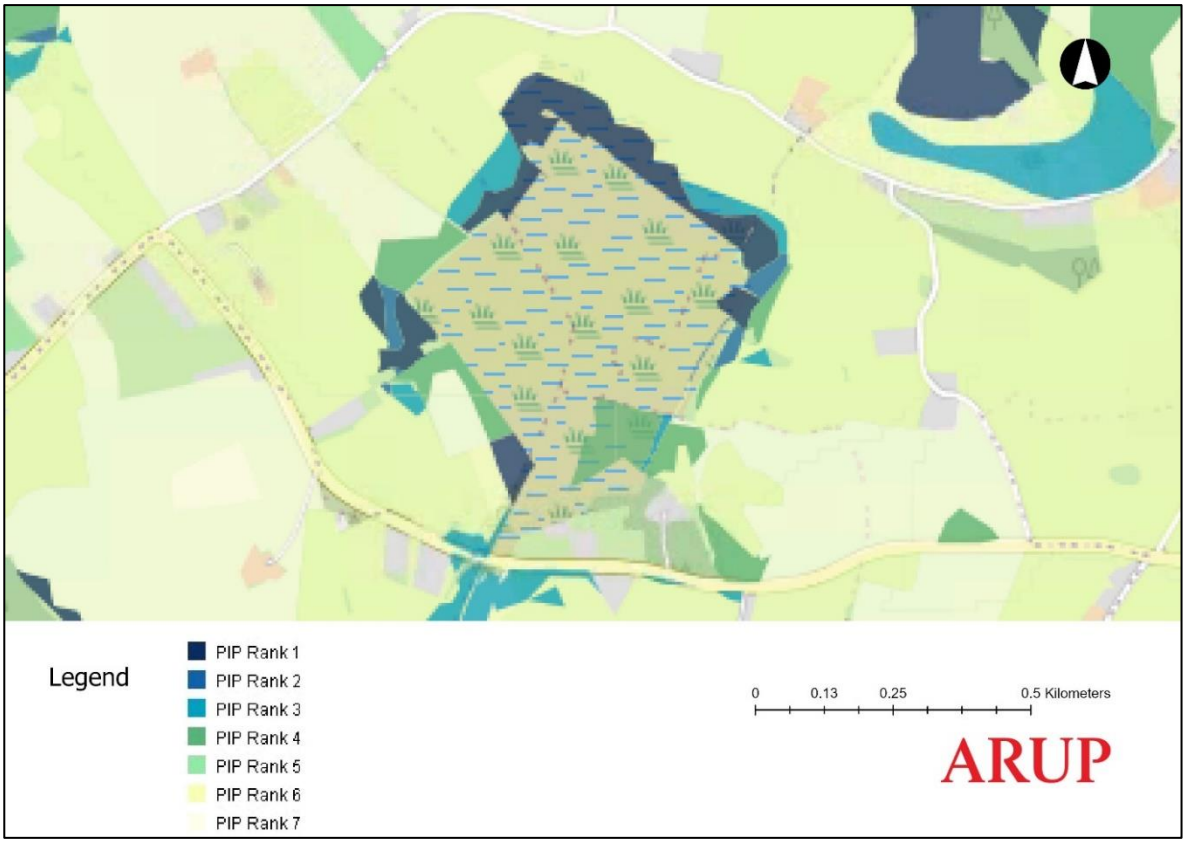


Figure 3-19: Pollution impact Potential for Phosphorus (EPA,2025)

Freely draining soils and substantial groundwater pathways are high risk for nitrate losses. Near surface nitrate susceptibility is high in areas of exposed rock or high groundwater vulnerability to the north-west and south-east (Figure 3-20). The sub-surface nitrate susceptibility is low in these areas (Figure 3-21).

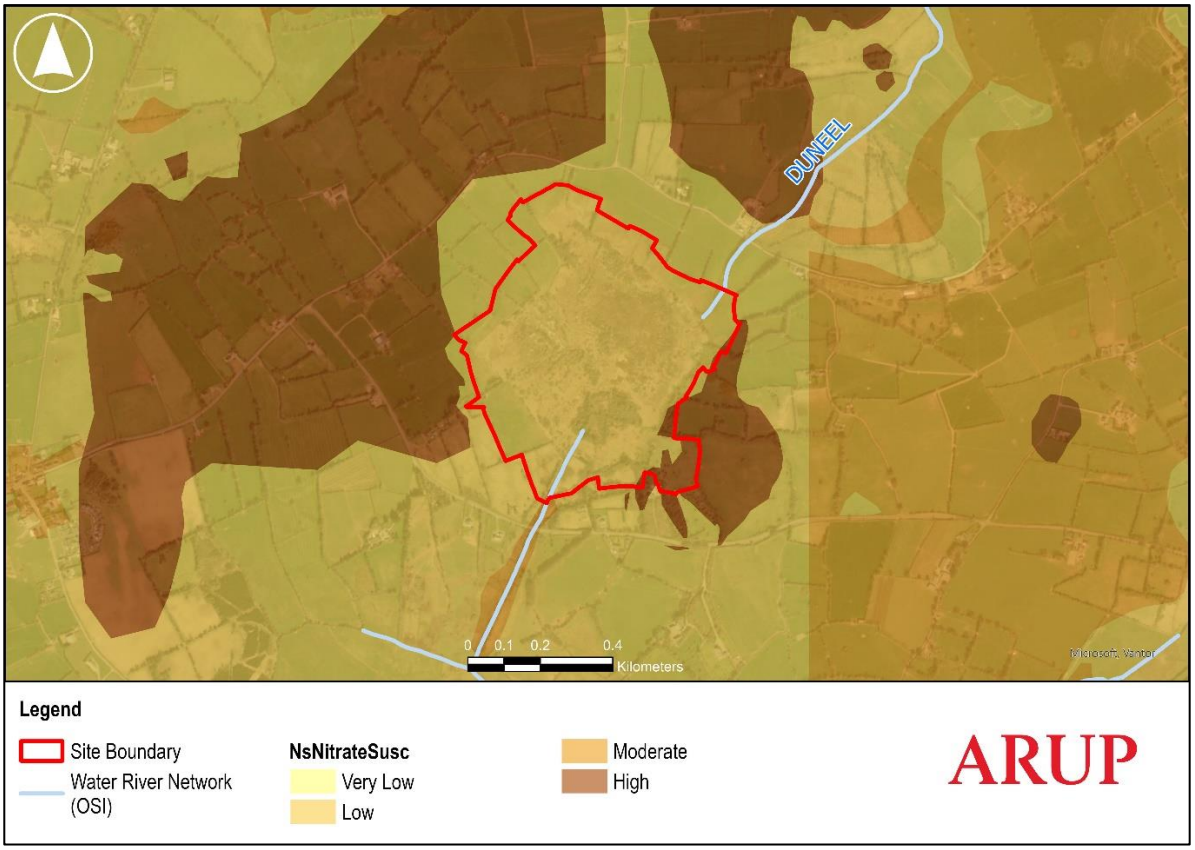


Figure 3-20: PIP maps (Near surface Nitrate Susceptibility) of Ballymore fen (EPA, 2025)

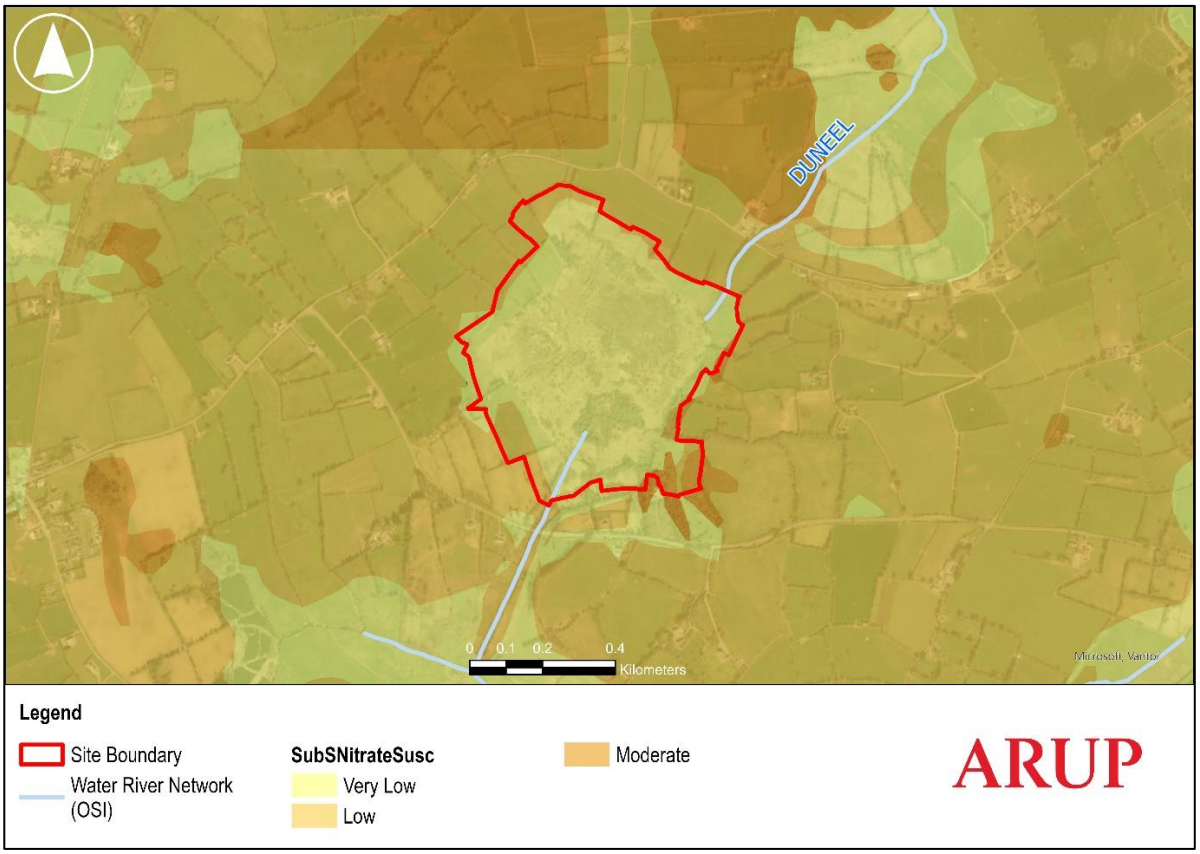


Figure 3-21: PIP maps (Sub surface Nitrate Susceptibility) of Ballymore Fen (EPA, 2025)

Similar findings were concluded from more recent water quality analysis undertaken by Bijkerk (2023) (Figure 3-22). Monitoring at Ballymore Transect 1 indicates predominantly downward hydraulic gradients in summer (Figure 3-22), facilitating infiltration of surface water and resulting in elevated dissolved reactive phosphorus (DRP) in surface and shallow subsurface layers. In winter, flow patterns shift to localised groundwater upwelling within the central fen while weaker downward gradients persist at the margins, with DRP largely absent from the free water table, likely due to dilution from increased surface water inputs and/or redox-controlled immobilisation processes (Bijkerk, 2023).

Results from Ballymore Transect 2 show a similar seasonal pattern to Transect 1. In summer, predominantly downward hydraulic gradients are observed (Figure 3-23), with minor localised upward flows attributed to variations in hydraulic conductivity within lower sediment layers rather than regional groundwater inputs, and DRP is present across the transect. In winter, DRP concentrations in the free water table decrease to very low levels, while downward gradients persist, particularly towards the fen margins and at Brownes Upper, indicating continued recharge and dilution processes (Bijkerk, 2023).

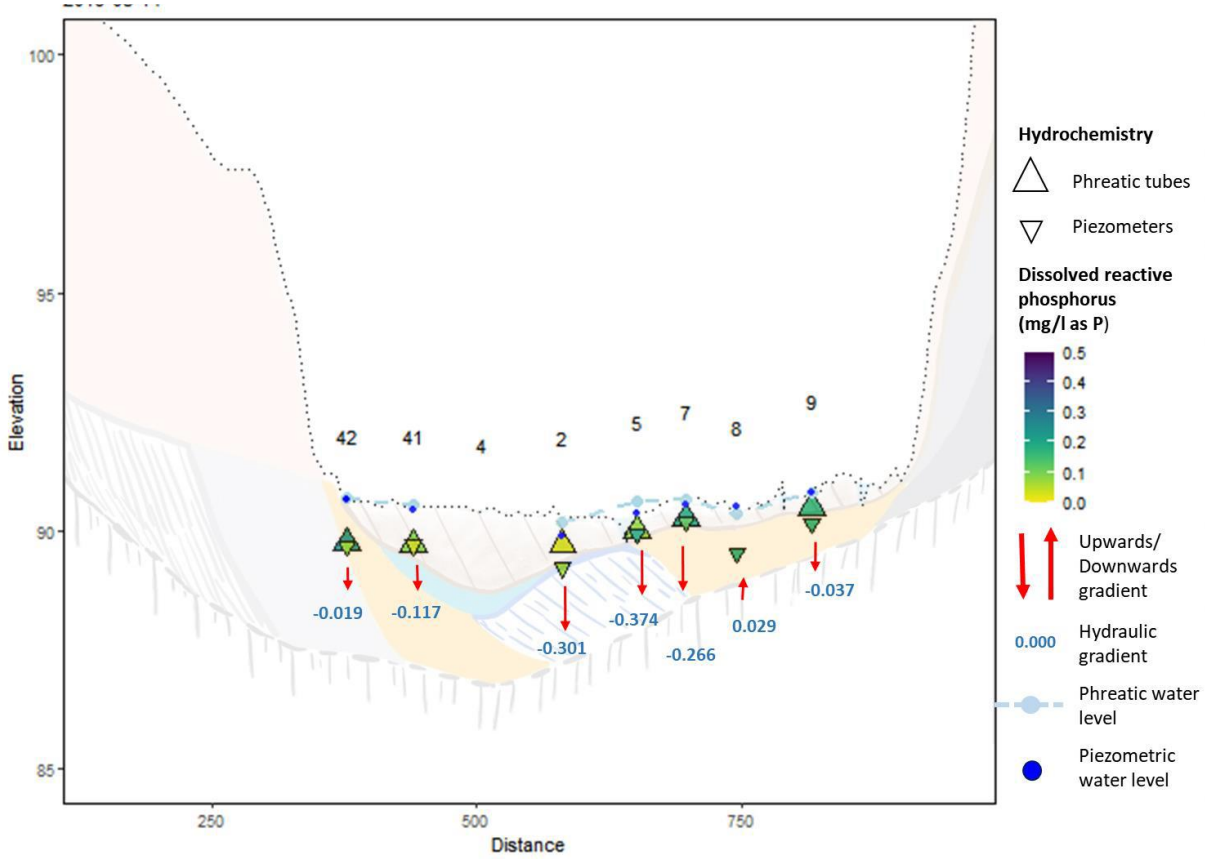


Figure 3-22: Hydrology and dissolved reactive phosphorus (mg/l as P) of Ballymore fen transect 1 in August 2019 (Bijkerk)

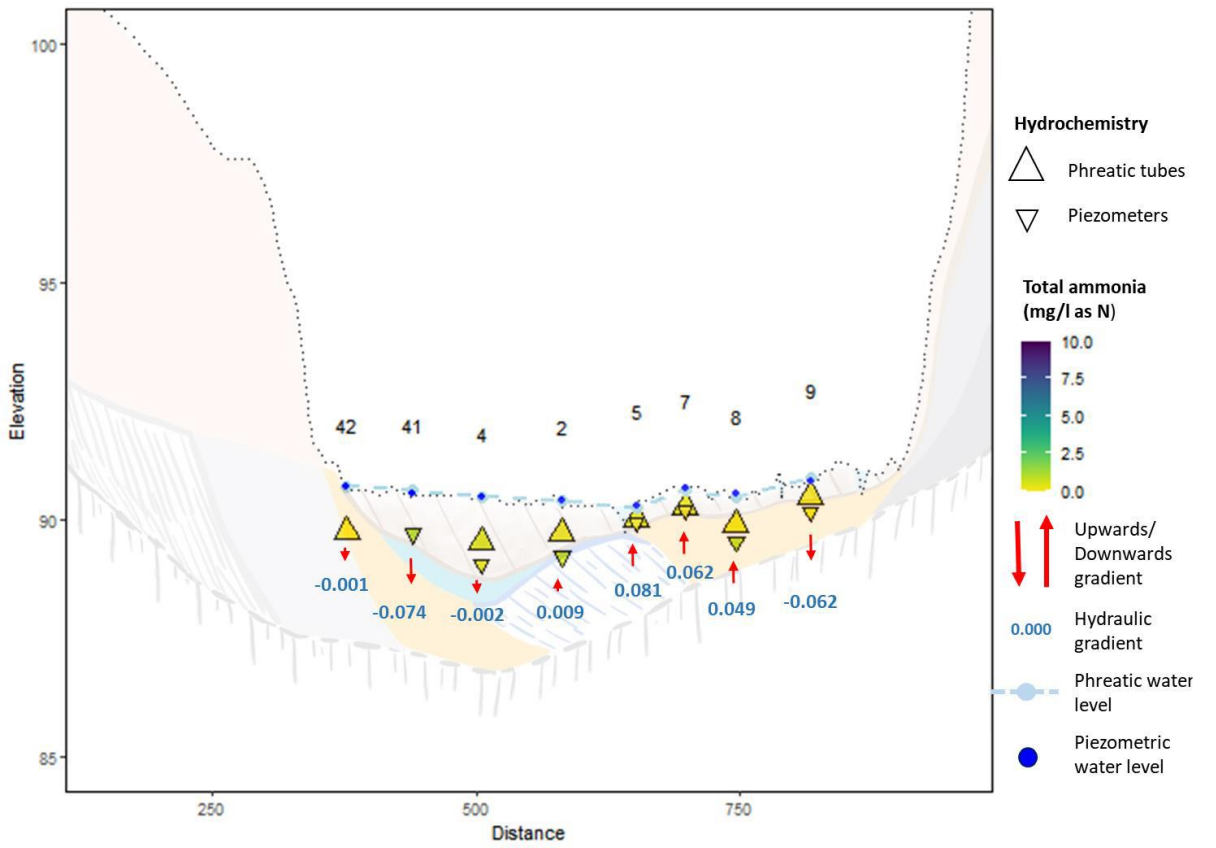


Figure 3-23: Hydrology and Total ammonia (mg/l as N) of Ballymore fen transect 1 in February (Bijkerk)

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, groundwater level monitoring in piezometers and observations of water flow in the drainage network.

Water quality data were collected across multiple areas within and around the site, including fens, transition mires, tufa springs, and associated watercourses. The parameters recorded included pH, EC, temperature, dissolved oxygen (DO), nitrate, and phosphate. Groundwater levels were monitored in selected piezometers, and peat depths were probed to assess substrate characteristics.

Field survey Monitoring locations are presented in Figure 3-24.

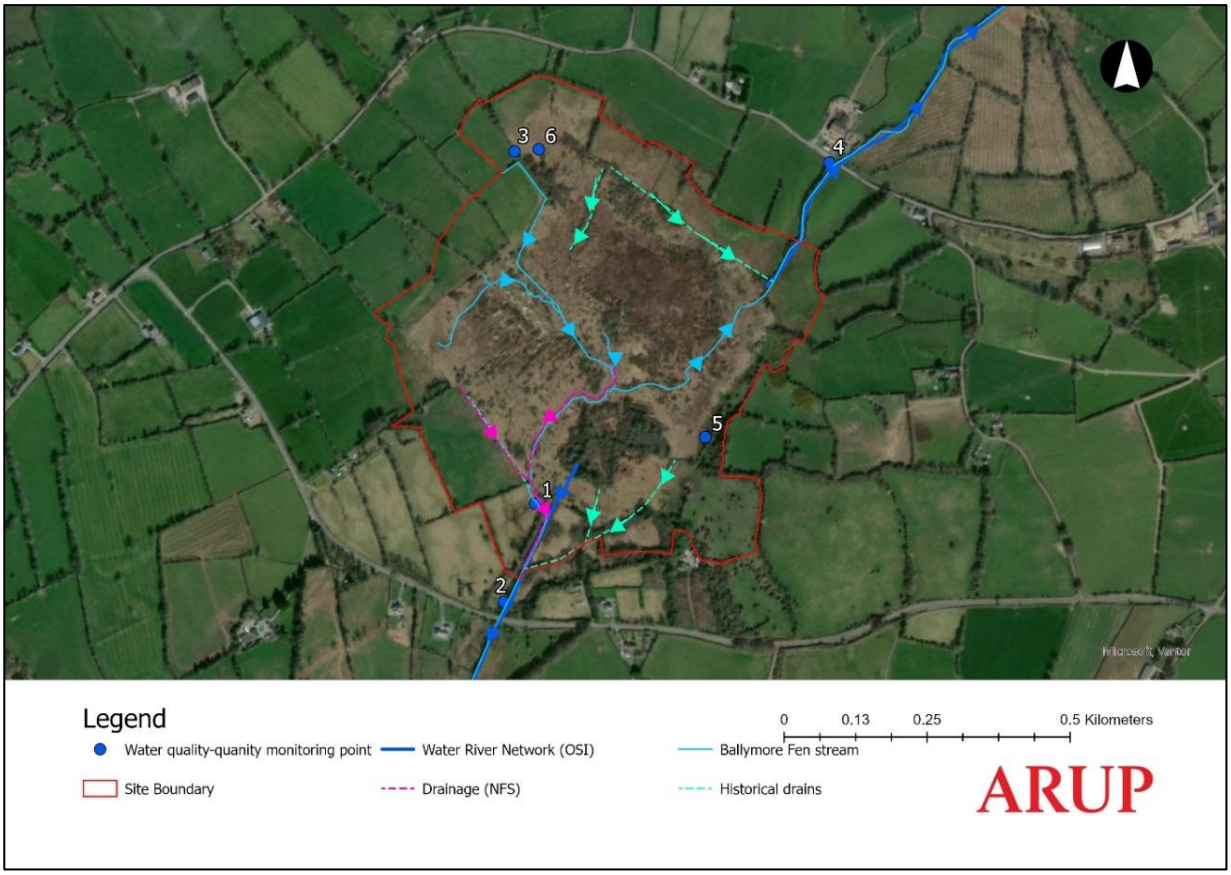


Figure 3-24: Field water monitoring locations

3.2.1 Peat Depth Probing and Ground Investigations

Peat depth data were recorded as part of the Scoping Study and Pilot Survey of Fens undertaken between 15 and 17 June 2020 (Brophy et al., In prep). Peat depth across the site ranged from 150cm to 223cm.

Peat depth across the site shows peat depth variability in peat accumulation. The peat depth in the northern part of the site is 1.0m. In the eastern area of the site the peat depth is 1.4m near the site boundary and ranges from 1.1-2.4m surrounding the fen stream in the central area. In the southern area peat depth is 0.6. Peat depth during the site surveys are shown in Figure 3-25.

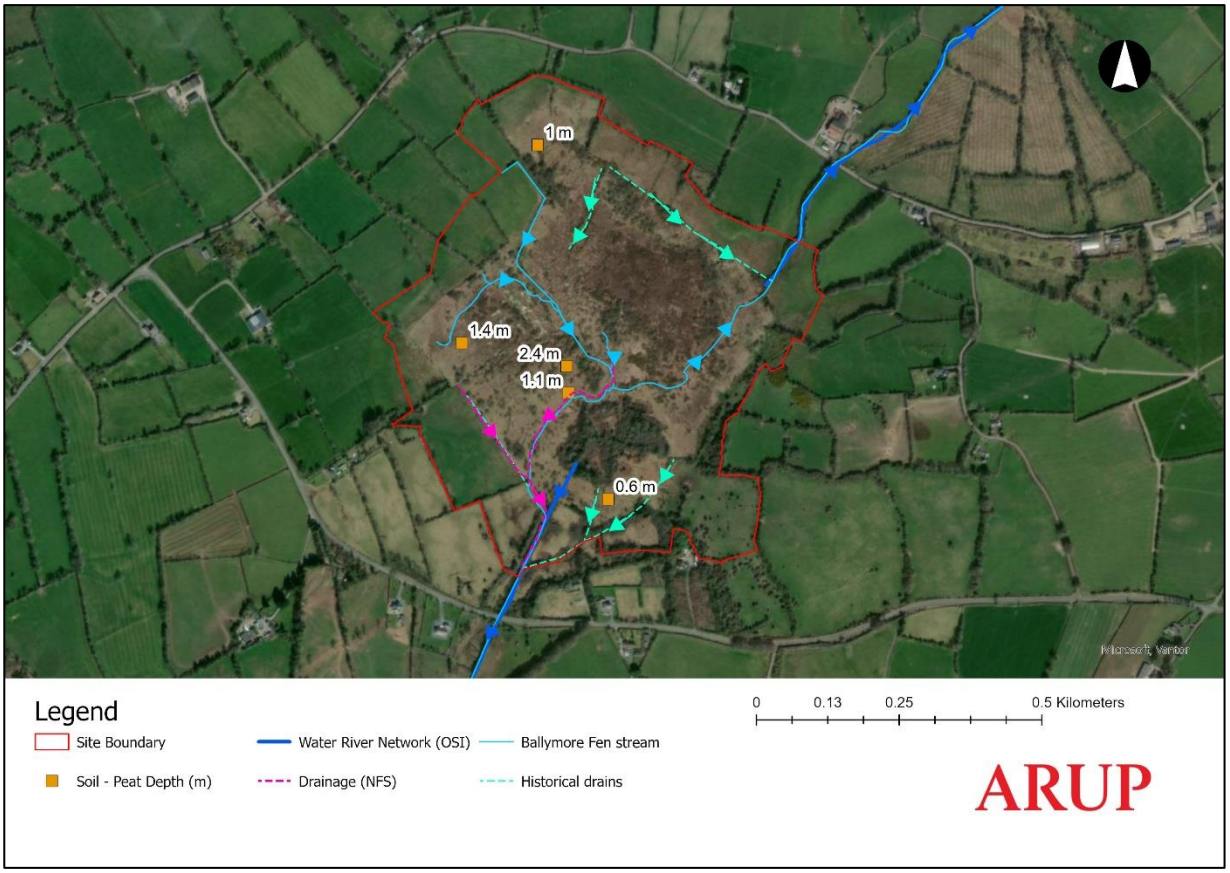


Figure 3-25: Peat depth (m) at Ballymore fen SAC.

3.2.2 Groundwater Levels and Springs

According to the historical maps four springs are located to the northwest of Ballymore fen. Previous studies have also identified springs in the western part of the site and have mentioned the seasonal dominance of groundwater during the summer months (Bijkerk, 2023). During the site sampling a spring was sampled in the north of the site and a seepage was sampled in the east of the site during winter (Figure 3-26).

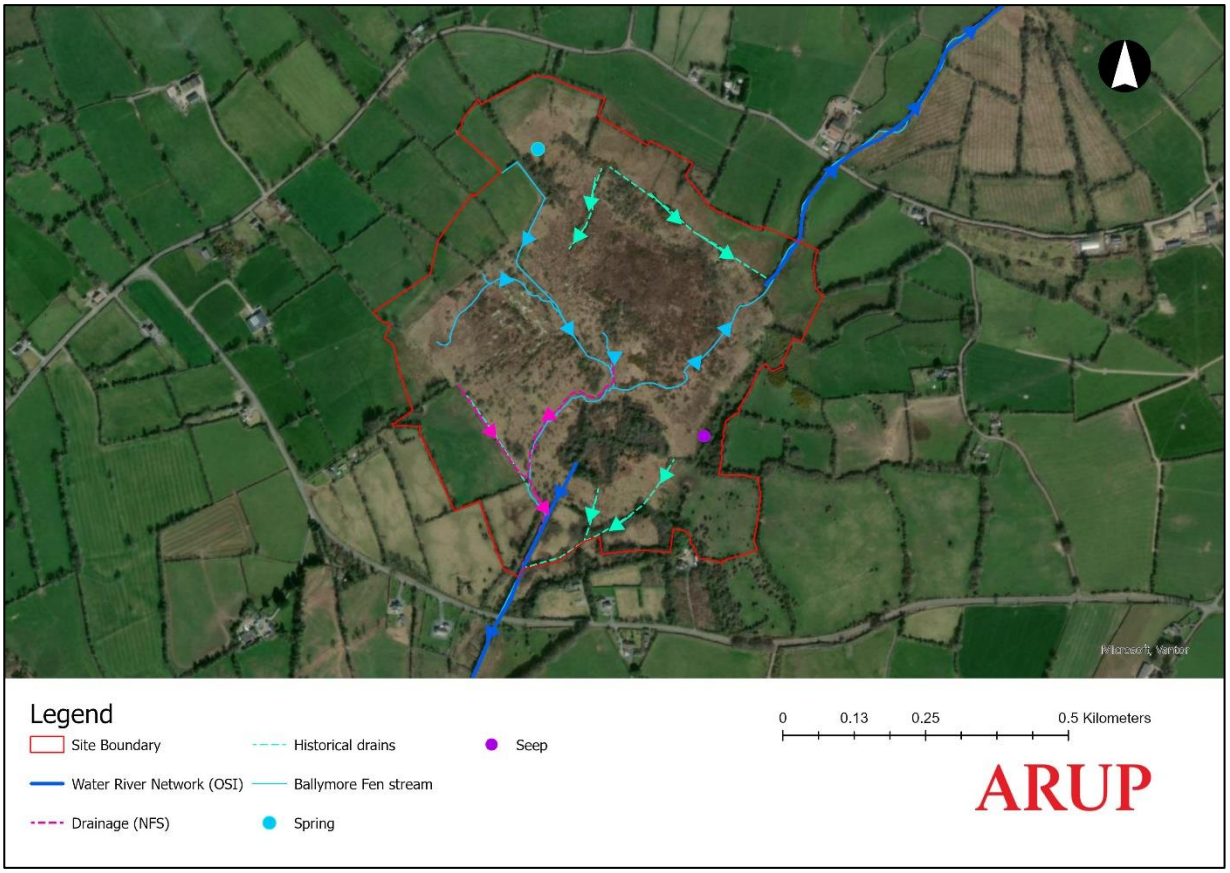


Figure 3-26: Spring and seepage monitoring locations at Ballymore fen SAC.

3.2.3 Surface Water levels

Due to the location of Ballymore Fen on a watershed the surface water conditions vary both spatially and seasonally. There are two main outflow drains: one in the southwest and one in the northeast. Both are arterial drains, which have been maintained for more than 200 years. The northwestern drain is shallow, about 2m wide and 0.4m deep, with low to moderate flow, running south under a road (ID 7). According to surrounding landowners the regional road (R390) was upgraded in the last five years, with the historical box culvert being replaced with a smaller pipe culvert. The northeastern drain is 0.5 m wide and 0.05 m deep, flows north and is also culverted under a local road (ID 4).

Within the site boundaries there is evidence of historical drainage near the boundary of the fen. According to previous research the south-western drain (ID 1) is more active in summer months, when groundwater is dominant. In the winter months, when the site sampling occurred, the more natural fen stream is dominant. The south-western drain (ID1) is flowing into the southern arterial drain (ID 7). The southern arterial drain is 3.0 m wide with a water level of 0.1 m deep. The arterial drain is infilled with short vegetation such as grass and moss. A seepage from the hillslope to the west has been directed towards a small drain which drains towards the southern arterial drain.

The springs on the north-western side of the site seem to have clearly defined flow paths, and in some cases deep drainage lines that flow towards the central fen. A spring (ID 3) was

identified on this side of the site that was connected to a 0.5 m wide, vegetated drainage channel (ID 6). The land surface was saturated and flow in the drain was slow. The two drains on the northern boundary drain towards the northern arterial drain.

Surface water monitoring locations and dimensions of drains are presented in Figure 3-27 and Figure 3-28.

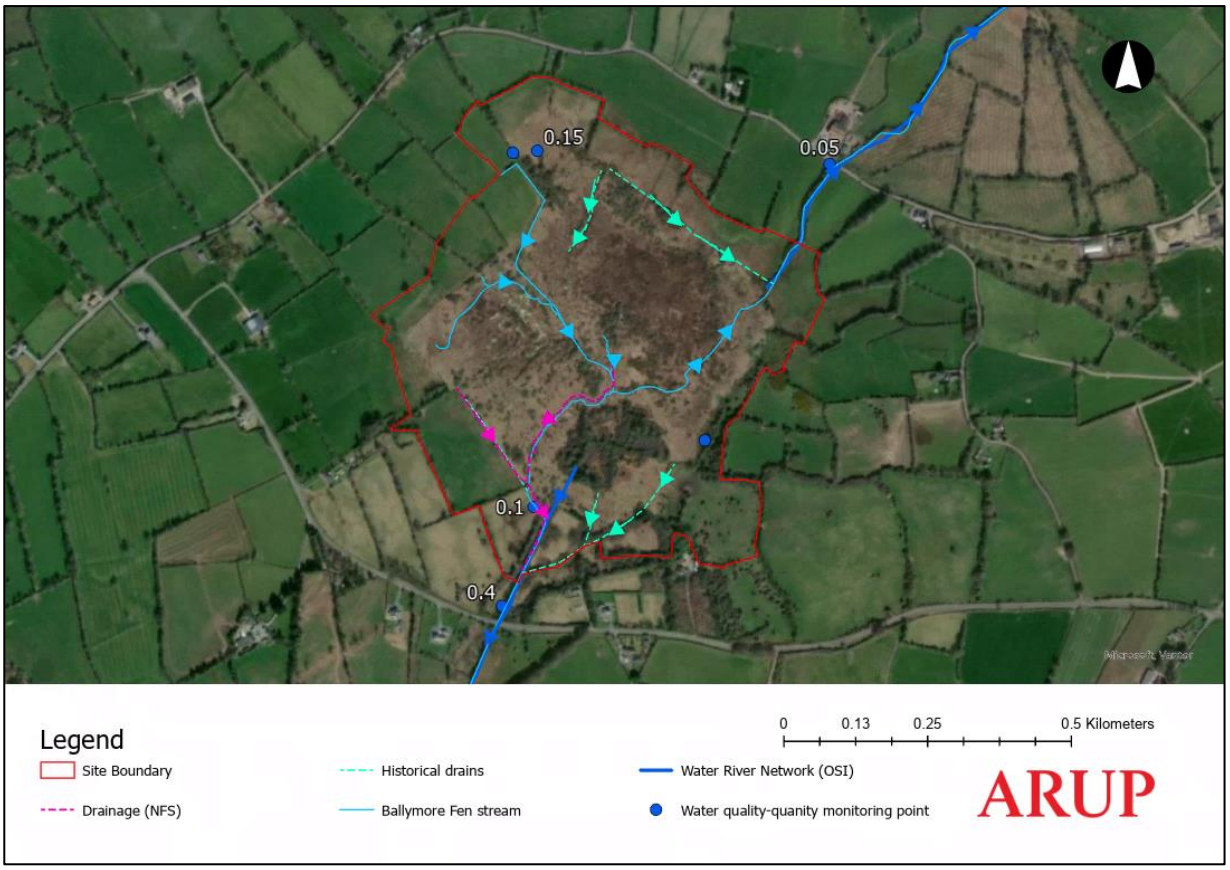


Figure 3-27: Water level (m) locations of Ballymore fen SAC

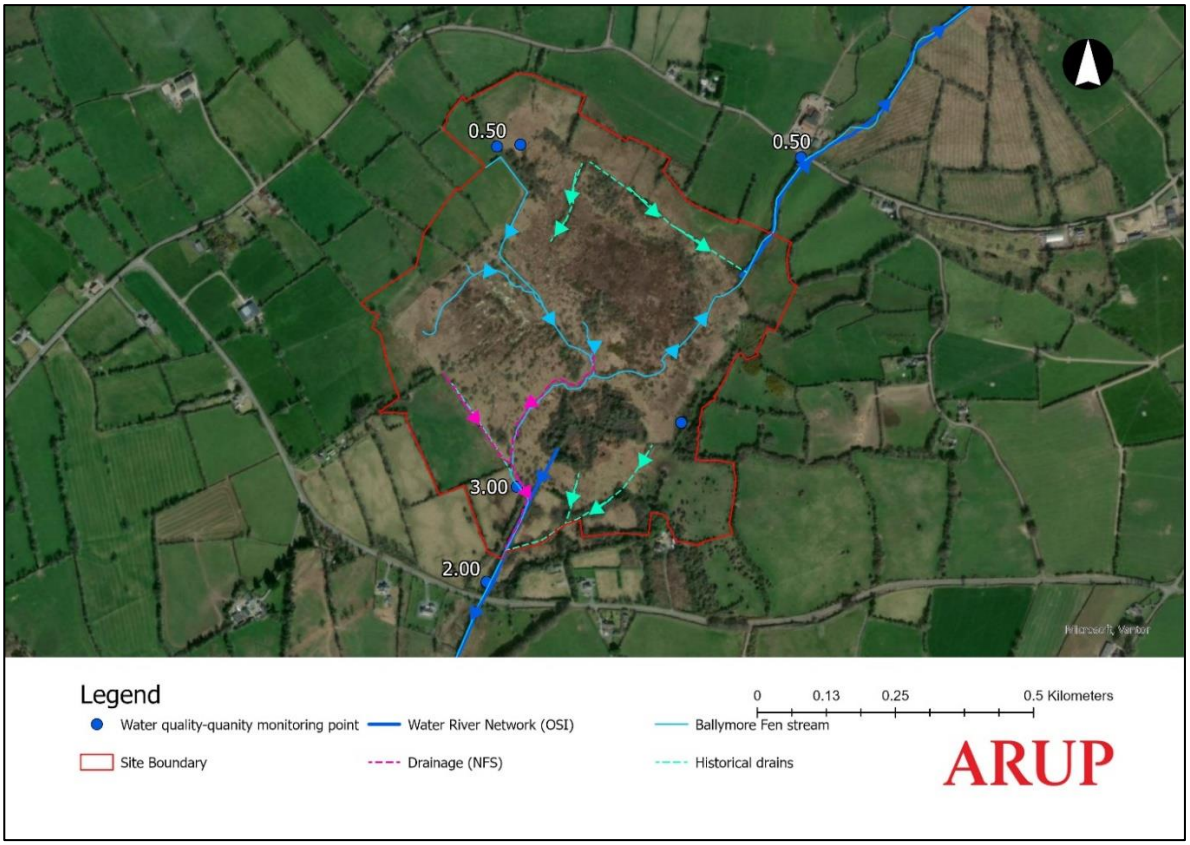


Figure 3-28 Drain widths (m) of Ballymore fen SAC

3.2.4 Water Quality

Electrical Conductivity (EC) and pH data were recorded as part of the Scoping Study and Pilot Survey of Fens undertaken between 15 and 17 June 2020 (Brophy et al., In prep). EC values ranged from 395 to 667 µS/cm and pH values ranged from 7.39-7.81.

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 southern outlet (ID 2) are high at 9.2 mg/l (NO_3-N), while the south-western drain (ID 1) shows a very high concentration of 65.2 mg/l (NO_3-N). The northern outlet (ID 4) had a lower concentration at 8 mg/l (NO_3-N).

Nitrate concentrations during the site surveys are shown in Figure 3-29.

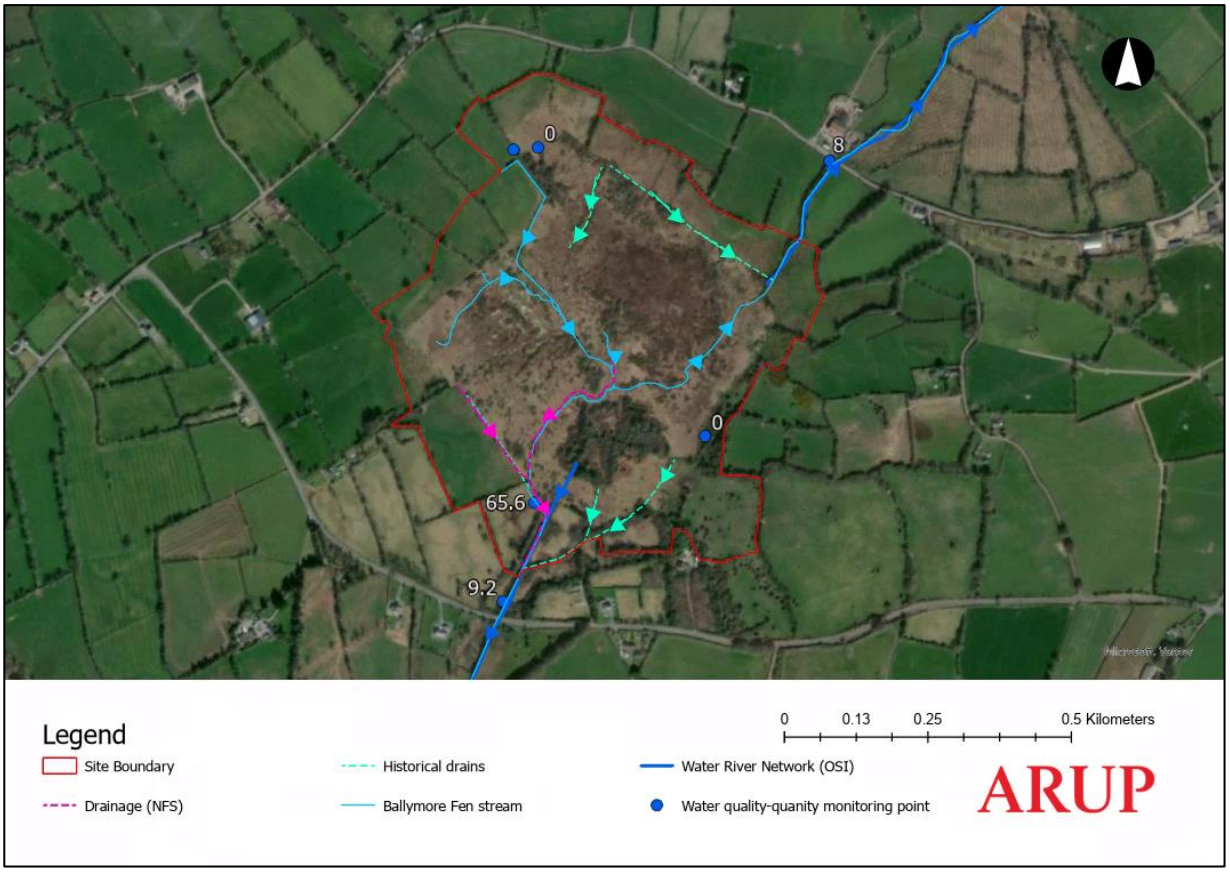


Figure 3-29: Nitrate (mg/l NO_3) at monitoring locations of Ballymore fen.

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[3]) set 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

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

0.14-0.37 mg/l PO4 (Figure 3-30) This spatial pattern also aligns with areas identified as being at risk in the EPA PIP maps for phosphorus (Figure 3-30).

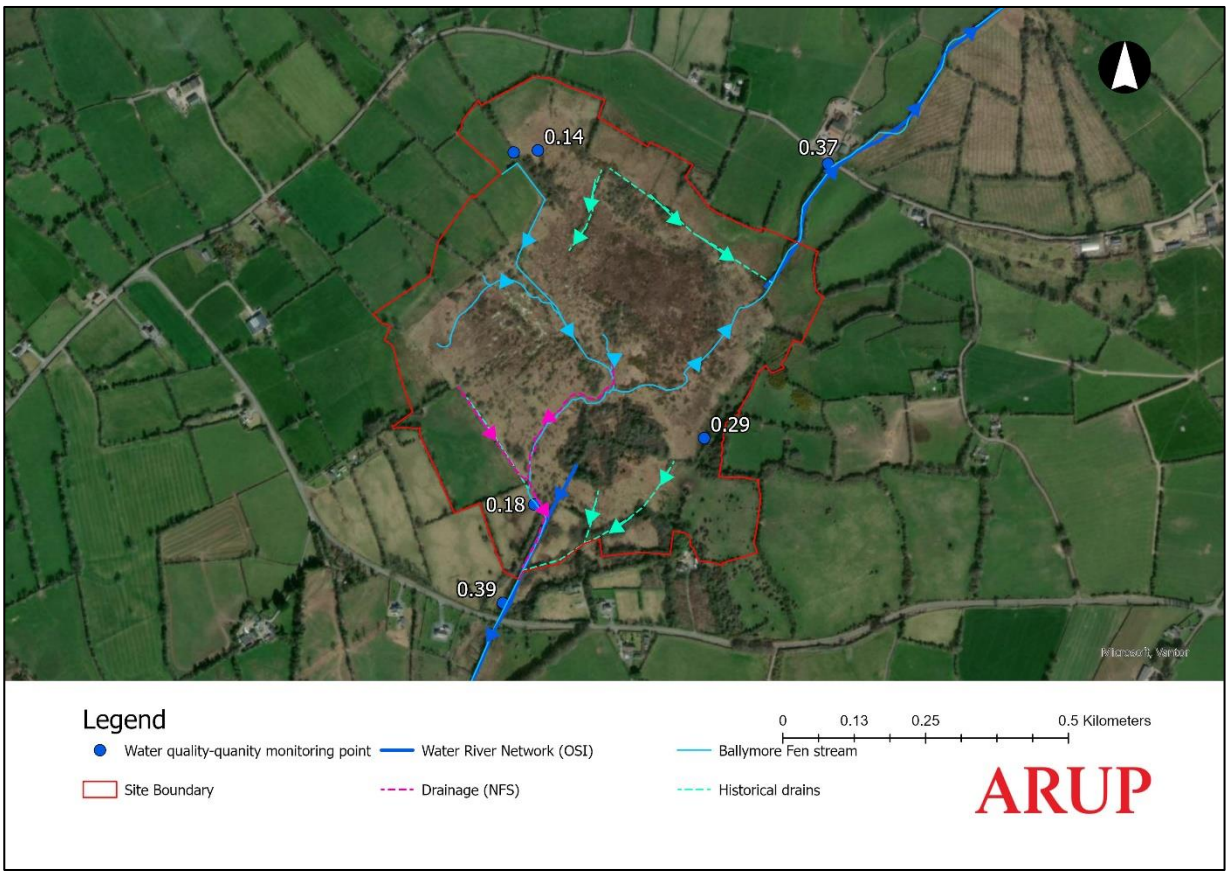


Figure 3-30: Phosphate (mg/l PO4)) at monitoring points of Ballymore Fen SAC

Electrical conductivity (EC) and pH were measured during field site visits. pH values ranged from 6.78 in the northern part of the site to 7.93 at the northern outlet (ID 4) to 7.28 at a seepage in the east (ID 5) (Figure 3-31). EC values ranged from 385 µS/cm at a spring in the north-west (ID 6), to 655 µS/cm at a seepage in the east (ID 5) (Figure 3-32).

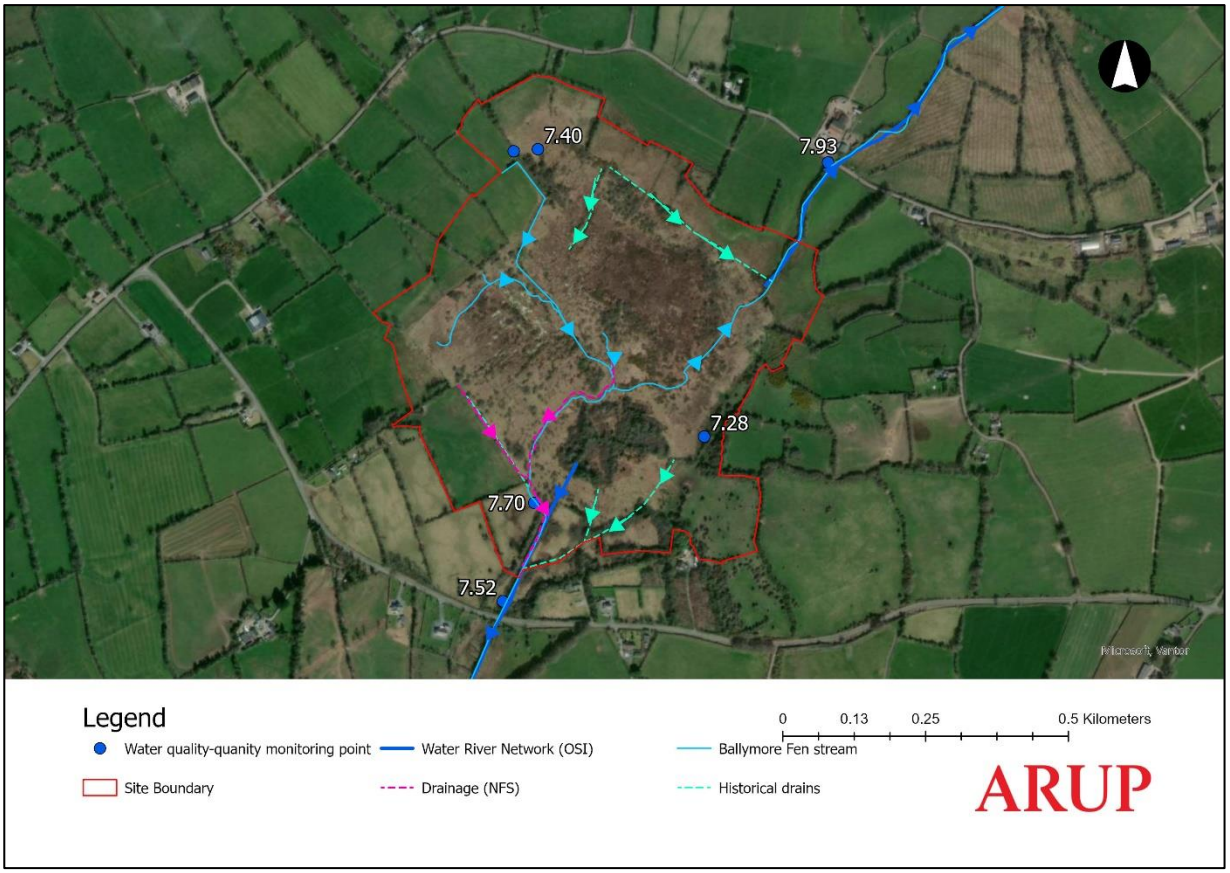


Figure 3-31: pH at water monitoring locations of Ballymore Fen SAC

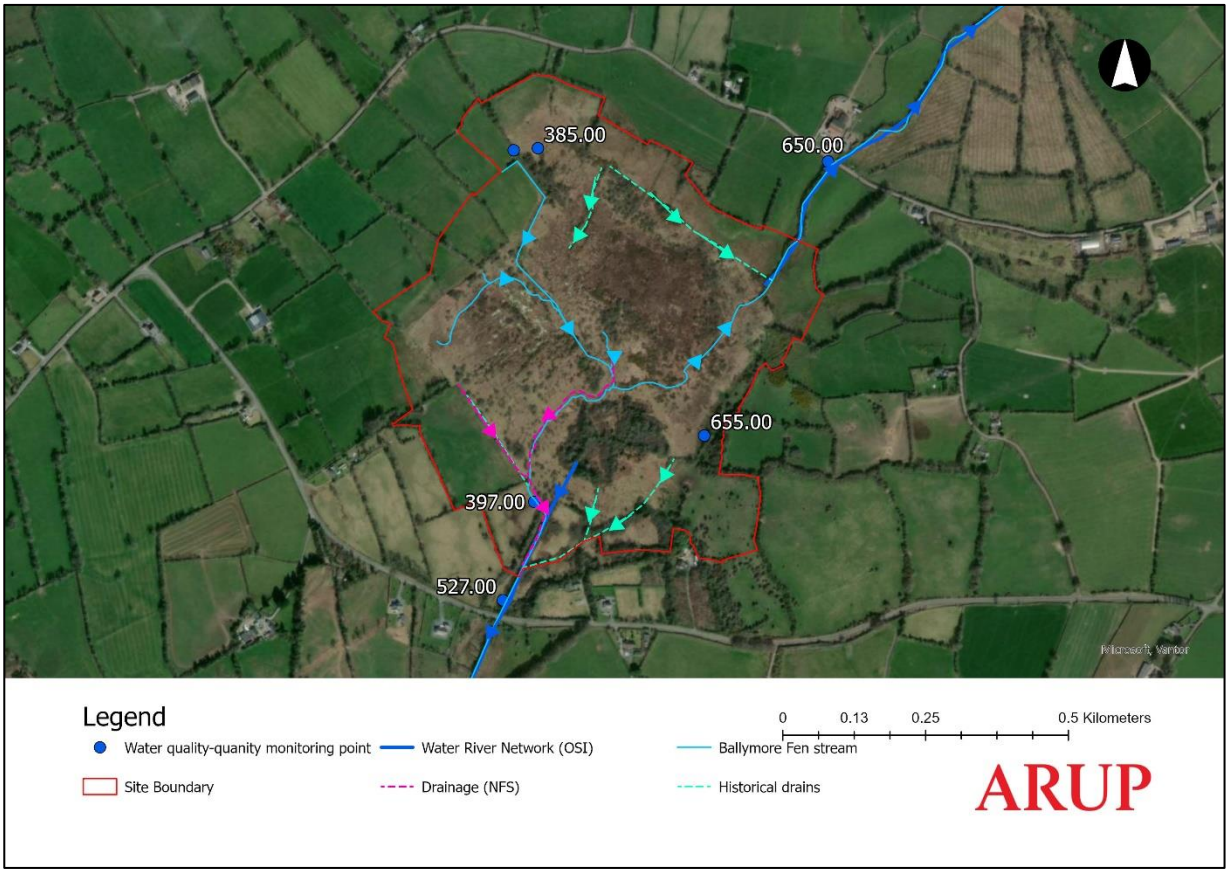


Figure 3-32: EC at water monitoring locations of Ballymore Fen SAC

3.3 Conceptual Site Model

Ballymore fen occurs at around 90m OD and occupies a flat, low-lying basin surrounded by higher ground. The site is underlain by karstified Waulsortian Limestone, forming a Locally Important aquifer that is moderately productive in shallow weathered and fractured zones. Overlying sediments include limestone-derived till, with localised alluvial and lacustrine deposits, reflecting glacial and post-glacial development. Peat deposits are deeper towards the centre of the site and thinner towards the site boundary.

The fen receives water supply from rainfall, springs and groundwater, with groundwater dominant in summer and surface water dominant in winter. Despite seasonal changes in inflows and outflows, surface water levels remain relatively stable. Groundwater–surface water interactions within the peat include both downward recharge and localised upwelling, leading to internal circulation. The fen functions as a natural nutrient buffer, with lower nutrient concentrations than the surrounding catchment and particularly low dissolved reactive phosphorus levels at the outlet during winter, reflecting dilution and attenuation processes.

Ballymore fen 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 Ballymore Fen should be **WETMEC 9: Groundwater-Fed Bottoms**. The discrete spring features in the north-west are **WETMEC 16: Groundwater-Flushed Bottom**.

The centre of the site represents **WETMEC 9a: Wet Groundwater-Fed Bottom**. The natural fen stream is seasonally active and more dominant in the winter according to previous studies. Nutrient levels are low. The areas of the site to the north and south represent **WETMEC 9b: Part-Drained Groundwater Bottom** under the influence of historical and current drainage. Drains towards the south had very high nitrate and high phosphate levels during site surveys.

There are two springs along the western border of the site representing **WETMEC 16a: Groundwater-Flushed Bottom** which discharge directly to the site without an associated watercourse. Peat is generally thin and according to previous studies dissolved reactive phosphorus levels are high. There is one spring along the western boundary of the site which is connected to a drainage channel. Peat is generally thin. Nitrate was low at the site but phosphate was high during site surveys. The drainage channel apparently rarely floods.

Ballymore Fen SAC
Westmeath County
Upper Shannon: MULLENMEEHAN STREAM_010, RATH_020
GW fed bottom (WETMEC 9) with GW flushed bottom (WETMEC 16)

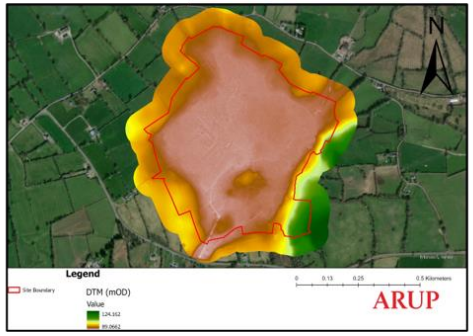
Water key:

Fen stream
Seasonal springs
Seasonal drains
Wetland vegetation

Cross section:



Location:



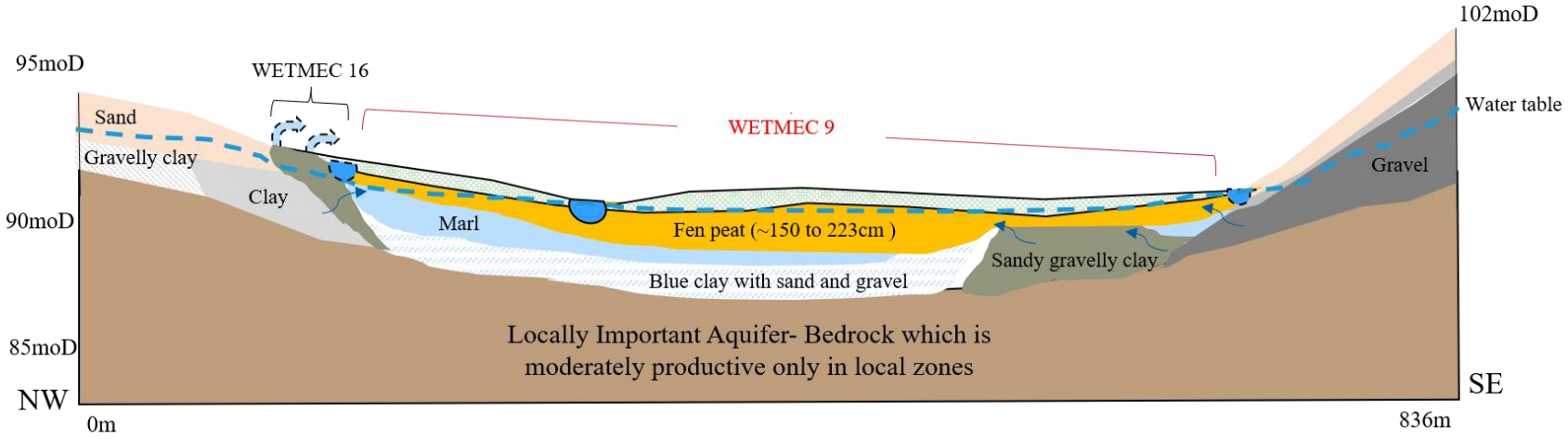


Figure 3-33 Conceptual site model of Ballymore Fen SAC

4 Ecology

4.1 Desk Study

A review of available desktop information on the ecological baseline for Ballymore Fen SAC was reviewed from the below information sources:

- NPWS Protected Sites – Special Areas of Conservation – Ballymore Fen SAC;
- NPWS Article 17 habitats distribution datasets;
- National Fen Survey (Brophy et al., In prep).
- Biodiversity Maps - National Biodiversity Data Centre (NBDC);
- Plant Atlas 2020 website - Botanical Society of Britain & Ireland (BSBI);

The NFS was commissioned to develop and test a standardised methodology for assessing the conservation status of fen habitats across Ireland. As part of this study, Ballymore Fen SAC in county Westmeath was selected as one of the sites for field survey. The site was surveyed in June 2023, with a focus on Annex I wetland and fen habitats. The survey methodology included:

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

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

4.1.1 Habitats

The NFS at Ballymore Fen revealed that the site comprises of a mosaic of transition mire and quaking bog, alkaline fen, improved agricultural grassland, wet grassland, cutover bog, rich fen and flush, poor fen and flush, wet willow alder ash woodland and bog woodland. A drain runs from the centre of the site south-west through the rich fen and flush and poor fen and flush, through the wet grassland where it exits the site.

4.1.1.1 Annex I Habitats

The following Annex I habitat was identified and mapped:

- **7140 Transition mires –** covering approximately 2.95ha of the site. Found predominantly in the south-west, centre and north-east of the site, it is bordered by areas of Annex I quality 7230 Alkaline fens and 7120 Degraded raised bogs still

capable of natural regeneration (hereafter referred to as 7120 Degraded raised bogs). The remainder of the site habitat which borders it is non-Annex habitat. Key species within the 7140 Transition mires include *Menyanthes trifoliata*, *Scorpidium scorpioides, Carex diandra, Epipactis palustris, Pyrola rotundifolia* and *Cratoneuron filicinum, Calliergon cuspidate, Calliergon giganteum and Dactylhoriza viridis (Cologlossum viride).* Despite having a favourable extent, the condition assessment indicates unfavourable-bad status for future prospects and overall condition. This is likely due to the presence of invasive alien species (*Rhododendron ponticum* and *Prunus laurocerasus*) and problematic native species (*Salix* sp., ungrazed *Schoenus*)

In addition to the designated Annex I habitat (7140 Transition mires) present at Ballymore Fen SAC, four additional Annex I quality habitats were identified on site. Annex I habitats are those formally listed under Annex I of the EU Habitats Directive and are recognised as qualifying features of a designated site, meaning they have legal protection and must be assessed and managed to meet site-specific conservation objectives. Annex I quality habitats, on the other hand, are areas that show the structure, species and ecological conditions typical of an Annex I type but are not designated features themselves; they often occur in mosaic with Annex I habitats and contribute to the ecological functioning of the fen system, yet they do not carry the same statutory reporting or conservation obligations. Furthermore, it should be noted that the resulting mapping of Annex I and Annex I quality habitats from the NFS survey requires suitable interrogation and interpretation as to the extent of these habitats within each polygon i.e. Annex I habitat mapping is represented by the habitat that has the highest percentage attributed to the polygon. Therefore, polygons could be a mosaic or only support a small percentage of Annex I habitat within the overall polygon area and thus require appropriate interpretation.

These Annex I quality habitats are:

- **7230 Alkaline fens** covering approximately 8.59ha. Located both in the north-west and the south-east of the site.
- **7120 Degraded raised bogs** covering approximately 2.75ha. Located in the north-eastern section of the site, flanked by 7140 Transition mires had been previously mapped and referenced in the NFS.
- **91D0 Bog woodland** covering approximately 0.4ha. Located adjacent to the degraded raised bog, this habitat is dominated by birch and sphagnum.
- **6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)** covering approximately 0.4ha located in mosaic with the 7230 Alkaline fens habitat to the south-east of the site.

4.1.1.2 Non-Annex/Fossitt habitats

Non-Annex I fen and other habitats were also recorded, with mapping based on Fossitt[4] (2000) classification. These are included in Table 4-1.

Table 4-1: Fossitt habitats recorded within Ballymore Fen

Habitat Type	Location	Notes
FL3 – Limestone/marl lakes	North west of the site	Located within rich fen and flush dominated habitat
GA1 – Improved agricultural grassland	See Maps in Appendix B	Located predominantly along the borders of the site; currently managed and utilised by agricultural activities.
GS1 – Dry calcareous and neutral grassland	Site borders	Located predominantly along the borders of the site; currently managed and utilised by agricultural activities.
GS2 – Dry meadows and grassy verges	Site borders	Located predominantly along the borders of the site; currently managed and utilised by agricultural activities.
GS4 – Wet grassland	See Maps in Appendix B	Dominates the north eastern section and southern section where drainage exits the site.
HD1 – Dense bracken	Central south	A thicket of dense bracken is located in a scrub dominated habitat parcel in the central south of the site.
PB1 – Raised bog	See Maps in Appendix B	Cutover bog located in the north east of the site bordered by bog woodland and rich fen and flush.
PF1 – Rich fen and flush	See Maps in Appendix B	Supports winter evergreen and species listed in Table 4-2
PF2 – Poor fen and flush		Supports species listed in Table 4-2
PF3 – Transition mire and quaking bog	See Maps in Appendix B	Supports species listed in Table 4-2 and Table 4-3
WL1 – Hedgerows	Small segments in the north west and south east	Very short segments of hedgerow present.
WN6 - Wet willow alder ash woodland	See Maps in Appendix B	Adjacent to rich fen and flush and cutover bog/raised bog habitat.
WN7 – Bog woodland	See Maps in Appendix B	Dominated by birch and sphagnum, rhododendron recorded as present.
WS1 – Scrub	See Maps in Appendix B	Adjacent to Transition mire and alkaline fen habitats.

4.1.2 Species

The following subsections outline the presence of species recorded at or within the zone of influence of the Ballymore Fen site. This includes protected species listed under relevant legislation and conservation frameworks such as the EU Habitats and Birds Directives (Annex I, II, IV, and V), the Irish Red Lists, and the Wildlife Acts (including species protected under the

[4] Fossitt habitats refer to the classification system outlined in A Guide to Habitats in Ireland by J.A. Fossitt (2000). It provides a standardised framework for habitat identification and mapping in Ireland, grouping habitats into hierarchical levels based on vegetation, landform, and ecological characteristics.

Flora Protection Order. Records are limited to those from the past ten years, reflecting the most plausible timeframe for continued presence and ecological relevance to the site - excepting where invasive species have been historically recorded and there has been no indication since of their elimination.

The site synopsis for Ballymore Fen SAC notes the presence of a range of notable fen and transition-mire species including *Menyanthes trifoliata*, *Equisetum fluviatile*, *Epipactis palustris*, *Potentilla palustris*, *Galium palustre*, *Angelica sylvestris*, *Ranunculus flammula*, and a diversity of *Carex* sedges. Of particular significance is the occurrence of the Red Data Book species round-leaved wintergreen *Pyrola rotundifolia*, found abundantly among *Schoenus*-dominated hummocks.

Additional noteworthy plants include *Osmunda regalis*, *Dryopteris dilatata*, *Berula erecta*, *Molinia caerulea*, various *Sphagnum* mosses and a suite of calcareous-grassland indicators such as *Dactylorhiza fuchsii*, *Briza media*, *Centaurea nigra*, *Leucanthemum vulgare*, *Koeleria macrantha*, *Lotus corniculatus*, *Plantago lanceolata* and *Hypochoeris radicata*.

The site also supports a selection of fauna associated with fen hydrology, including 10-spined stickleback, common frog and smooth newt, as well as five recorded odonates: *Aeshna grandis*, *Aeshna juncea*, *Orthetrum coerulescens*, *Coenagrion puella* and *Coenagrion pulchellum*.

4.1.2.1 Species Within the Site

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

Table 4-2: Species records within Ballymore Fen SAC

Common Name	Latin name	Description	Most recent record
Round leaved wintergreen	*Pyrola rotundifolia*	Rare, Near Threatened; occurs in alkaline fens and transition mires with stable hydrology	2026
Marsh helleborine	*Epipactis palustris*	Widespread but declining orchid Occurs in fens, damp grassland, marshes and dune slacks, typically on calcareous wetland soils	2023
Early-marsh orchid	*Dactylorhiza incarnata*	Native; Found in calcareous fens, damp dune slacks, machair grassland, and fen–bog transition zones depending on subspecies	2023
Smooth newt	*Lissotriton vulgaris*	Irelands only native amphibian; breeds in ponds, ditches and shallow wetlands; associated with wetland mosaics including fen margins where aquatic vegetation supports egg-laying.	2022

Common Name	Latin name	Description	Most recent record
Common frog	*Rana temporaria*	Protected under Wildlife Acts and Annex V; breeds in wetland habitats including transition mires.	2019

4.1.2.2 Species within the Zone of Influence

Table 4-3 outlines the functionally linked species recorded within the 2km distribution zone of influence around Ballymore Fen SAC within the last ten years from NBDC.

Table 4-3: Species records within the Zone of Influence of Ballymore Fen SAC

Legislative Protection	Common name	Latin name
Irish Wildlife Act	Common Frog	*Rana temporaria*
Irish Wildlife Act	Barn Owl	*Tyto alba*
Irish Wildlife Act	Black-headed Gull	*Chroicocephalus ridibundus*
EU Birds Directive	Cormorant	*Phalacrocorax carbo*
EU Birds Directive	Curlew	*Numenius arquata*
EU Birds Directive	Gadwall	*Mareca strepera*
EU Birds Directive	Golden Plover	*Pluvialis apricaria*
EU Birds Directive	Great Crested Grebe	*Podiceps cristatus*
EU Birds Directive	House Martin	*Delichon urbicum*
EU Birds Directive	House Sparrow	*Passer domesticus*
EU Birds Directive	Kestrel	*Falco tinnunculus*
EU Birds Directive	Lapwing	*Vanellus vanellus*
EU Birds Directive	Mallard	*Anas platyrhynchos*
EU Birds Directive	Meadow Pipit	*Anthus pratensis*
EU Birds Directive	Mute Swan	*Cygnus olor*
EU Birds Directive	Pheasant	*Phasianus colchicus*
EU Birds Directive	Pintail	*Anas acuta*
EU Birds Directive	Pochard	*Aythya ferina*
EU Birds Directive	Robin	*Erithacus rubecula*
EU Birds Directive	Sand Martin	*Riparia riparia*
EU Birds Directive	Shoveler	*Spatula clypeata*
EU Birds Directive	Snipe	*Gallinago gallinago*
EU Birds Directive	Sparrowhawk	*Accipiter nisus*
Irish Wildlife Act	Spotted Flycatcher	*Muscicapa striata*
No legislative protection	Starling	*Sturnus vulgaris*
Irish Wildlife Act	Swallow	*Hirundo rustica*
EU Birds Directive	Teal	*Anas crecca*
Irish Wildlife Act	Tree Sparrow	*Passer montanus*
EU Birds Directive	Tufted Duck	*Aythya fuligula*
EU Birds Directive	Wigeon	*Mareca penelope*
EU Habitats Directive	White-clawed Crayfish	*Austropotamobius pallipes*
No legislative Protection	Round-leaved Wintergreen	*Pyrola rotundifolia* subsp. rotundifolia

Legislative Protection	Common name	Latin name
EU Habitats Directive	Moss Carder Bee	*Bombus muscorum*
Irish Wildlife Act	Badger	*Meles meles*
EU Habitats Directive	Common Pipistrelle	*Pipistrellus pipistrellus sensu stricto*
Irish Wildlife Act	Hedgehog	*Erinaceus europaeus*
EU Habitats Directive	Otter	*Lutra lutra*

4.2 Field Survey

Following a comprehensive review of available desktop data, a targeted ecological survey was undertaken in March and August 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 Ballymore Fen SAC, 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 seven No. pre-identified monitoring points (Monitoring Points 1-7), 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 site conditions.
- Long-term monitoring stations to assess ecological change following restoration.

The survey focused on these key components:

- Monitoring points: Presence and absence of positive and negative indicators of fen habitat.
- Target notes: Any qualitative observations capturing for example site condition, vegetation structure, hydrological features, and legacy management.
- Pressures and Threats Identification: Systematic recording of anthropogenic and natural pressures affecting each location.

There were a total of seven monitoring points surveyed across the site with 7230 Alkaline fens and PF1 Rich fens confirmed at Monitoring Points 1,3 and 6. Monitoring Points 2,4 and 7 supported 7140 Transition mire and PF3 Transition more and quaking bog habitat and Monitoring Point 1 supported 7220 Petrifying Springs and FP1 Calcareous springs.

4.2.2 Pressure & Threats

This section outlines the historical and current pressures and threats affecting transition mire and fen habitats at Ballymore Fen SAC, with emphasis on the Annex I habitat of 7140 Transition mires and the Annex I quality habitat of 7230 Alkaline fens.

4.2.2.1 7140 Transition mires

Historical Pressures

The NFS (Brophy, In prep) determined that the overall status of 7140 Transition mires habitat at Ballymore Fen was unfavourable – bad, with negative pressures relating to other invasive alien species, drainage and problematic native species (scrub encroachment).

- **Invasive non-native alien species** in the form of *Rhododendron ponticum* and cherry laurel *Prunus laurocerasus* was recorded in 7140 Transition mires habitat, which may increase in density over time without management.
- **Drainage** occurs with a drain located in the centre of the site that flows southwards, joined by a boundary drain which buffers along improved agricultural grassland to the west. This exists as a localised and minor threat as dedicated EPA research has shown that the drain is not currently affecting the 7140 Transition mires habitat.
- **Scrub encroachment** (referred to as problematic native species) is arising from ongoing natural succession in the site, leading to shifts in species composition and a decline in characteristic transition mire species. Monitoring of the cover of species, in addition to conservation grazing (low intensity grazing by appropriate livestock e.g.

Current Observations

The 2026 walkover surveys identified the following:

- Invasive non-native alien species reconfirmed the presence of two cherry laurel patches
- Drainage at an unmapped drain at the south side of the site is infilling with bulrush Typha latifolia and bottle sedge *Carex rostrata*. It is bounded by gorse and willow scrub, indicating at least a local drawdown effect.
- Scrub encroachment a single 3.5m tall beech tree was recorded between the cherry laurel.

- Water quality patchy green algae was occasional in the surface water of the fen on the west side of the site.

4.2.2.2 7230 Alkaline fens

Historical Pressures

The NFS determined that the overall status of the Annex I quality Alkaline fens habitat at Ballymore Fen was unfavourable – bad, with negative pressures relating to drainage and problematic native species.

- **Drainage** occurs with a drain located in the centre of the site that flows southwards, joined by a boundary drain which buffers along improved agricultural grassland to the west. This exists as a localised and minor threat as dedicated EPA research has shown that the drain is not currently affecting the fen habitat
- **Problematic native species** arising from Grazing management could remedy the cover tall Schoenus fen where low intensity grazing would be deployed over a suitable grazing period by appropriate stock (e.g. Kerry blue cattle).

4.2.3 Additional Observations

- During the 2026 walkover survey, small amounts of paludal tufa was recorded at Monitoring Point 1.

4.3 Site Conservation Priority Matrix for Ballymore Fen

The restoration actions proposed (Table 4-4) for the SAC habitat of Ballymore Fen SAC 7140 Transition mires 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 SAC habitats alone but extend to the wider ecological network within and around the site.

Table 4-4: Site Conservation Priority Matrix for Ballymore Fen

Level	Feature Type	Feature Name	Extent/ Population	Pressure/Threat	Restoration Measure On-Site	Restoration Measure Off-Site
1	SAC Habitat	7140 Transition mires	2.95ha	Drainage Scrub encroachment Invasive alien species	Vegetation monitoring Invasive alien species (cherry laurel) removal Grazing Management (where appropriate) Hydrological monitoring	Buffer zone management (scrub encroachment and drainage management)
2	NHA Habitat	7230 Alkaline Fens	8.59ha	Drainage Scrub encroachment	Scrub removal (where necessary) Hydrological monitoring	Buffer zone management (scrub encroachment and drainage management)
		7120 Degraded raised bogs		No pressure/threat identified	N/A	N/A
		7220 Petrifying springs		No pressure/threat identified	N/A	N/A
		91 D0 Bog woodland		Invasive alien species	Invasive alien species (rhododendron) removal	Buffer zone management (scrub encroachment and drainage management)
		6410 Molinia meadows		No pressure/threat identified	N/A	N/A
3	European Priority Species	See Table 4-2 Table 4-3	See Table 4-2 Table 4-3	Habitat degradation via scrub encroachment	Vegetation monitoring Scrub removal (where necessary) in FS1 PF1, PF2 and PF3 habitat zones	Buffer zone management (scrub encroachment and drainage management)
3	Nationally important species	See Table 4-2 Table 4-3	See Table 4-2 Table 4-3	Habitat degradation via scrub encroachment	Vegetation monitoring Scrub removal (where necessary) in FS1 PF1, PF2 and PF3 habitat zones	Buffer zone management (scrub encroachment and drainage management)
4	Habitats and species of local interest	PF1 – Rich fen and flush	See Appendix B	Drainage Scrub encroachment Invasive alien species	Vegetation monitoring Invasive alien species removal Scrub removal (where necessary) Hydrological monitoring	Buffer zone management (scrub encroachment and drainage management)

Level	Feature Type	Feature Name	Extent/ Population	Pressure/Threat	Restoration Measure On-Site	Restoration Measure Off-Site
		PF2 – Poor fen and flush	See Appendix B	N/A	N/A	N/A
		PF3 – Transition mires and quaking bogs	See Appendix B	Drainage Scrub encroachment Invasive alien species	Vegetation monitoring Invasive alien species removal Scrub removal (where necessary) Hydrological monitoring	Buffer zone management (scrub encroachment and drainage management)
		FP1 – Calcareous springs	See Appendix B	N/A	N/A	N/A
		GS4 – Wet grassland	See Appendix B	Scrub encroachment Invasive alien species	Vegetation monitoring Invasive alien species removal Scrub removal (where necessary) Hydrological monitoring	Buffer zone management (scrub encroachment and drainage management)

4.4 Impact Assessment Notes

Restoration actions proposed for Ballymore Fen SAC aim to improve the ecological condition of sensitive fen habitats, particularly Annex I habitats 7140 Transition mires and the Annex I quality habitats of 7230 Alkaline fens, 7120 Degraded raised bogs and 91D0 Bog woodland habitats present on site. These actions are designed to support favourable conservation status and enhance habitat resilience. However, potential impacts—both direct and indirect—must be carefully assessed to ensure compliance with Article 6(3) of the Habitats Directive.

The restoration measures proposed for Ballymore Fen SAC are directly connected to the management of the SAC and inherently connected with maintaining the favourable conservation status of the site's qualifying interest: 7140 Transition mires.

Potential Impacts

- **Habitat loss** – low risk - Restoration action (i.e. scrub removal) is designed to enhance existing habitats rather than remove them. Loss of habitat is not expected from scrub removal.
- **Habitat degradation –** moderate risk - Potential degradation could occur if restoration measures are poorly implemented or monitored. This could occur where scrub removal without follow-up could lead colonisation by invasive species or access to the site for continued ecological and hydrological monitoring is undertaken without due care. Some temporary impacts to habitats are anticipated for the purpose of access, but the long-term benefits of implementing actions outweigh the potential temporary impacts.
- **Species disturbance** – very low risk – Temporary disturbance will occur during implementation of restoration actions. Species impacted by this disturbance may include amphibians and invertebrates which are not considered to be particularly sensitive to temporary disturbance in discrete areas of the site.
- **Accidental pollution release** – low risk – It is recommended that the removal of cherry laurel, rhododendron and the beech tree are followed by stem injection to effectively control the scrub following removal. Therefore, herbicide will be used. An appropriate methodology will be followed to ensure no overflow. 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 Ballymore Fen SAC 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 Ballymore Fen SAC is summarised in Table 5-1.

Table 5-1: Conservation Status Assessment [based on NFS results for Ballymore Fen SAC]

OVERALL CONSERVATION STATUS ASSESSMENT				
Annex I habitat	Area	Structure & functions	Future prospects	Overall Conservation Status
7140	2.95ha	Unfavourable-bad	Unfavourable-bad	Unfavourable-bad
7210	N/A	N/A	N/A	N/A
7230	8.59ha	Unfavourable-bad	Unfavourable-bad	Unfavourable-bad

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 point were recorded. A summary is provided within Section 5.2.

5.2 Key Pressures

An overview of the key pressures identified on site, following desktop review and site visits are summarised in this section.

5.2.1 Flora and Fauna Pressures

The following pressures are listed in order of their intensity and impact on the ecological receptors of Ballymore Fen. These were determined from the review of historical information (NFS) and gathered from observations made along the monitoring points carried out as part of this project (Figure 5-1).

- Invasive non-native alien species - reconfirmed the presence of two cherry laurel patches
- Drainage - an unmapped drain at the south side of the site is infilling with bulrush and bottle sedge. It is bounded by gorse and willow scrub, indicating at least a local drawdown effect.
- Scrub encroachment a single 3.5m tall beech tree was recorded between the cherry laurel.

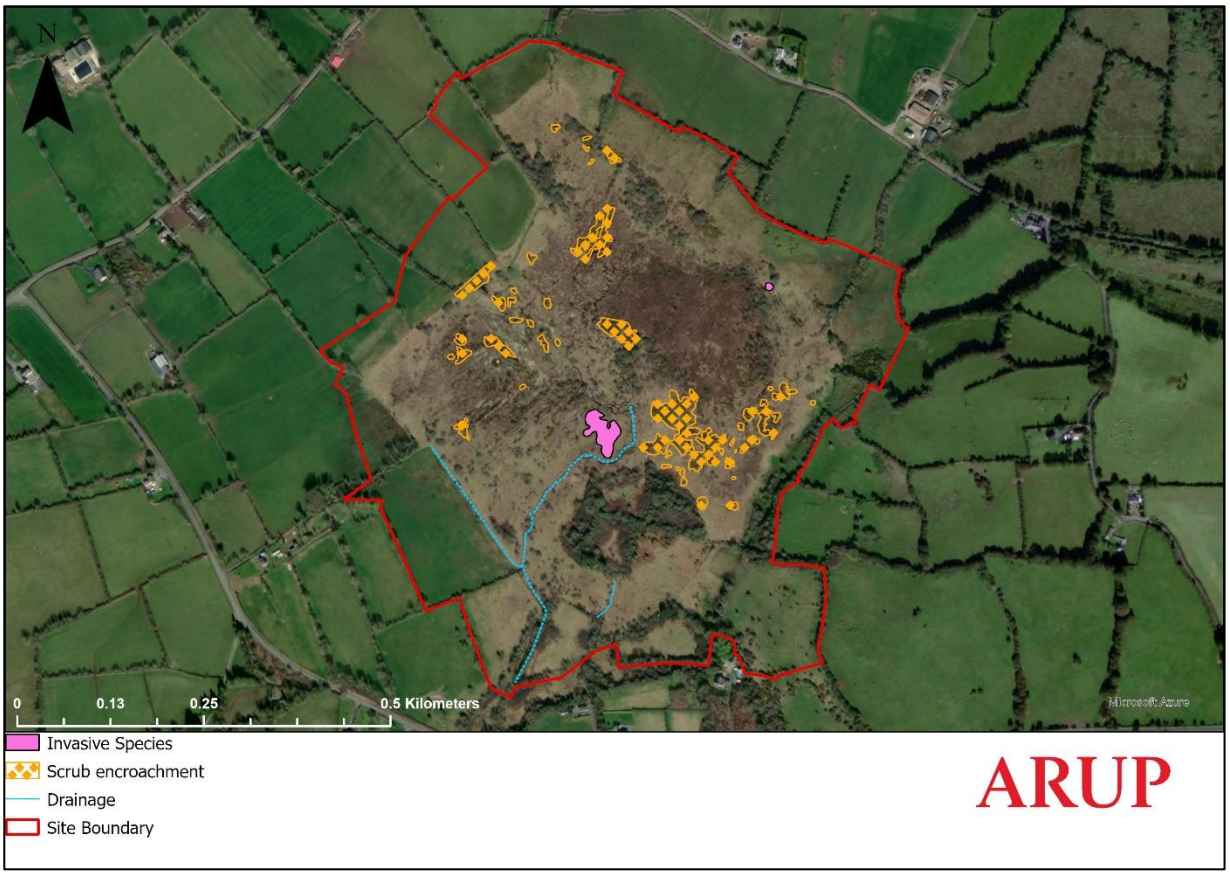


Figure 5-1: Flora & Fauna Pressures mapped within the site

5.2.2 Fen Hydrology Pressures

The following hydrological pressures were identified within Ballymore Fen SAC:

- Drainage has not been identified as a key pressure. One drain located within the habitat to the south shows localised impacts and has been highlighted as pressures requiring targeted management.

5.2.3 Fen Nutrient Pressures

Diffuse pollution from agricultural activities presents nutrient pressure on the fen habitat. Land use in the surrounding areas, specifically in the southwest, is contributing to nutrient enrichment and eutrophication.

From historical maps springs are located to the west of the site, within the site boundary. The land surrounding the wells is dry according to the Water and Wetness status map, which suggest that the wells are altering the surface flow paths. This will affect nutrient enrichment in the fen.

All identified pressures and threats, whether historical or currently observed, have been fully considered within the FRP to guide appropriate remediation. The proposed suite of restoration measures, encompassing both hydrological and vegetation interventions, is designed to maintain and improve the condition of Annex I habitats present within Ballymore Fen, while delivering co-benefits to associated non-Annex habitats and protected species. The prioritisation of pressures was informed by a review of historical data (including the NFS) and detailed observations recorded at monitoring points during this project. These measures, supported by ongoing vegetation and hydrological monitoring, will contribute to the preservation of habitat structure and function, promptly address threats, and help to safeguard the ecological integrity of the site into the future.

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 desk 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 to Section 6.3, with detailed mapping of proposed measures illustrated in the maps provided in Appendix C.

6.2 Hydrology Measures

6.2.1 On-site Hydrology Measures

The hydrological restoration objective for Ballymore Fen SAC is to improve 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 arterial drains, the objective for the site will be to focus on smaller drains in support of local water level improvement for 7140 Transition mire habitat to the south.

Small drain blocking to the south-east

According to the CSM the eastern part of the site is underlain with Waulsortian limestone and fen peat. The fen peat layer is shallower here than the centre of the site, at below 0.6m, and may be overlying sandy gravelly clay. The depth of peat should be confirmed prior to installation of drainage measures as there may be patches of mineral soil and gravel. Should peat dams not be deemed appropriate then stone dams should be used.

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).

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 such as FENCES weather station) will be compiled alongside habitat condition assessments to track restoration progress and support adaptive management of measures if monitoring indicates under-performance.

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.

6.2.2.2 Arterial drainage management plan with OPW

Ballymore Fen is located within the Inny Arterial Drainage Scheme, which is managed by the Office of Public Works (OPW) under the Arterial Drainage Act, 1945. Consultation with OPW is required in relation to the maintenance and function of the C8/7/3 and C12/8 drainage channels, the implications of any future drainage proposals for the fen, and the potential effects of the proposed restoration measures on the objectives of the arterial drainage.

The proposed restoration works will not interfere with the operation or maintenance of the drainage channel and will not involve new drainage excavation or alterations to existing drainage infrastructure. Any future drainage-related works within the Drainage District remain the responsibility of the relevant drainage authority and will be subject to appropriate consultation and environmental assessment.

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[5].
- Introduction, or re-introduction, of plants or animals not found in the area[6].

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

- Digging, ploughing, harrowing or otherwise disturbing soil or substrate[6].
- 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 frameworks such as Farming for Water EIP[7] or novel approaches under NPWS Farm Plans[8] 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 Ballymore Fen SAC 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 Pathway interception within site boundary

- The existing pathway interception measures on the border of the site should be maintained and new pathway interception measures proposed. These will include Establishing and maintaining hedgerows along the site boundary. A hedgerow buffer will promote sediment deposition and nutrient uptake. There are two options for hedgerows:
    - Maintain existing hedgerows along the border of site or wetland area. Currently there is about 1.5 km of existing hedgerow to the east of the site and about 1.3

[6] 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.

[7] 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.

[8] 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.

km to the west of the site. These need to be maintained to ensure they continue to act as nutrient and sediment buffers. Any removal of hedgerow will require consent.

- Develop new hedgerows where none exist. On the western part of the site there are areas with no hedgerows separating farming fields from the downstream wetland. The measure involves the construction of a low earthen bund, with a hedgerow established either on or adjacent to the bund. This configuration functions to attenuate surface runoff, increasing hydraulic resistance and promoting the interception and temporary storage of water at the base of the hedgerow (Farming for water EIP, 2023). Vegetation management needs to be undertaken to support the growth of the hedgerows.

- Riparian and bunded buffer along the farm side of north-eastern and southern drains. A spatially targeted riparian buffer to intercept and retain pollutants transferred from adjacent fields by surface and subsurface pathways. Recommendations are to:
  - Maintain a minimum buffer width (typically 5–10 m), subject to site constraints.
  - Restricting fertiliser application, grazing, and any soil disturbance within the buffer zone.
  - Promoting natural regeneration of vegetation.
  - Preventing access by machinery within the buffer during maintenance operations.

Monitoring progress

Water quality monitoring within the fen to verify that nutrients and sediments are being trapped.

6.3.1.3 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. Locations are to include the two arterial drains, existing piezometer network (FENCES) and the fen stream.

6.3.2 Off-site Nutrient Measures

6.3.2.1 Agricultural nutrient management

Livestock drinking water points present a potential source of nutrients to the fen. Alternative water supply may include:

- Alternative water supply, water troughs, piping and fittings. Alternative water supplies for livestock include pasture pumps and solar powered pumps with water troughs. Consultation with the farmer will be required to establish a suitable location for the water supply.
- Bovine, Ovine exclusion from waterbodies. Access to the fen for water supply should be prevented with a permanent fence.

6.3.2.2 Catchment nutrient management

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 runoff is an issue around Ballymore Fen.

Nitrate is likely to enter the fen through groundwater pathways, primarily via the gravel aquifer to the north/northeast of the site which provides flow to the springs along the northeastern boundary. Measures proposed to address excess nitrate entering the habitat should focus on the groundwater catchment providing flow to the northeast of the site.

Suitable measures for Ballymore Fen may include source control measures (Farming for Water EIP, 2023):

- **Farmer Training Course for farmers** in the fen catchment.
- **Nutrient Management Plan**. Such a plan will enable farmers in the catchment to achieve optimum slurry application and nutrient uptakee and avoid overapplication of nutrients.
- **Nitrogen Surplus**. A nutrient accounting approach is applicable to dairy farms and may be appropriate to address excess nitrate in the habitat's groundwater catchment.

6.4 Vegetation Measures

6.4.1 On-site Vegetation Measures

Table 6-1 details on-site vegetation measures.

Table 6-1: On-site vegetation measures proposed for Ballymore Fen

Priority	Measure	Description	Responsibility
1	Vegetation monitoring	Monitoring points have been proposed which overlap with (where suitable) the existing NFS points. The purpose of these points is to monitor species composition within the habitat. This serves to monitor the rate, if any, of succession and/or general scrub encroachment which in turn informs the need for further works outside the Tóchar FRP. Due to the nature of the site being so wet, it is recommended that consistent monitoring of both vegetation and hydrology (through piezometers) is	Tóchar & NPWS (post-Tóchar)

Priority	Measure	Description	Responsibility
		undertaken to provide a suitable baseline of information which can then inform further measures.	
2	Scrub removal (inclusive of invasive alien species)	Removal of the two cherry laurel patches, rhododendron and the single beech tree adjacent to the cherry laurel. The recommended control method following cutting is stem injection.	Tóchar

7 Additional Considerations

7.1 Drainage Management Plan

Ballymore Fen is located within the Inny Arterial Drainage Scheme, which is managed by the OPW. Consultation with OPW is required in relation to the maintenance and function of the C8/7/3 and C12/8 drainage channels, the implications of any future drainage proposals for the fen, and the potential effects of the proposed restoration measures on the objectives of the arterial drainage.

The preliminary drainage management plan for Ballymore fen is presented in Appendix D.

7.2 Peat Stability Assessment

Restoration activities have the potential to introduce additional risk of peat stability issues. The combination of additional loading (e.g. when excavators are used) and a higher water table has the potential to increase risk. At present, no specific guidance is available in Ireland detailing how peat stability risks should be managed in restoration projects.

Undertaking detailed geotechnical assessments is beyond the scope of the FRP. However, preliminary peat stability analysis was undertaken to inform the level of assessment required prior to the implementation of restoration actions. This includes a review of the landslide susceptibility map and historic landslide events produced by the Geological Survey of Ireland (GSI). The GSI landslide susceptibility map provides a preliminary indication of the susceptibility of a landslide based on several contributing factors, including where previous landslides have occurred and what caused them (slope, soil type and the impact of the flow of water in an area).

The proposed approach to peat stability is a tiered approach that aims to filter out low risk sites that can proceed with limited ground investigation, followed by more complex sites that require a more detailed quantitative assessment. Where risks cannot be excluded following these steps it may be necessary to progress to more detailed geotechnical studies.

The paths of moderately high landslide susceptibility will be avoided by the excavators. The GSI landslide susceptibility map for Ballymore Fen SAC is presented in Figure 7-1. And indicates a low landslide susceptibility rating.

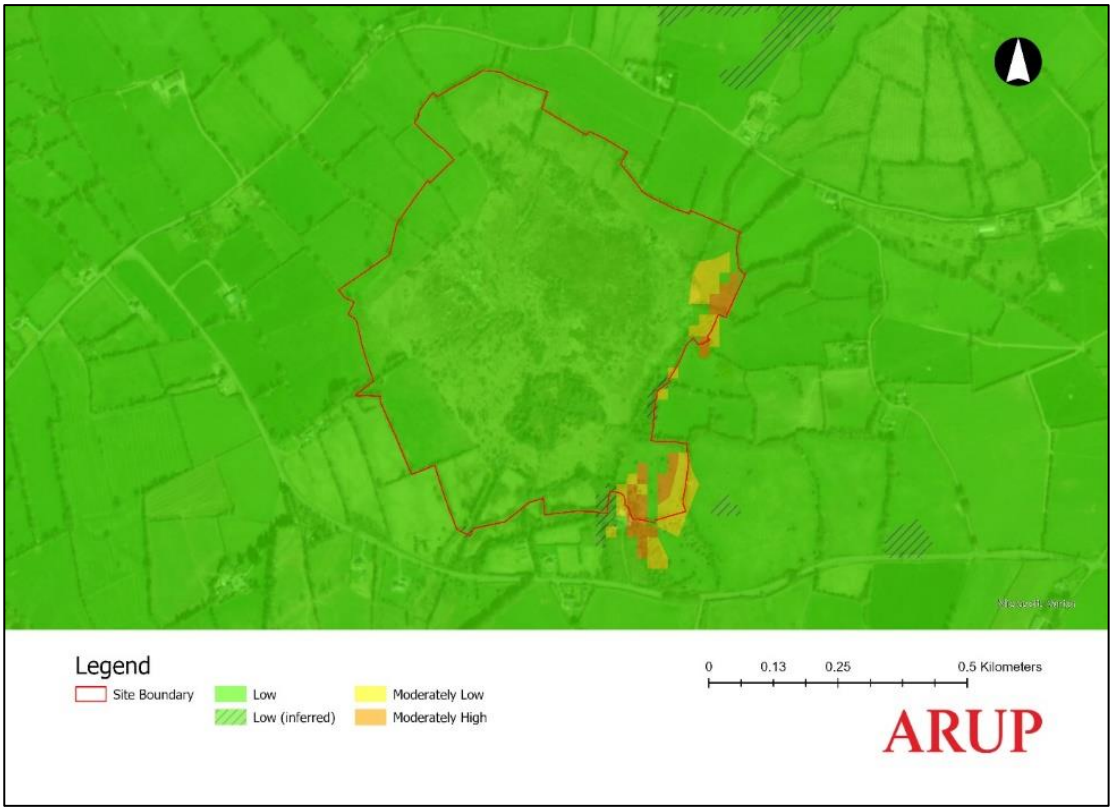


Figure 7-1: Geological Survey of Ireland Landslide Susceptibility mapping for Ballymore Fen SAC

7.3 Archaeology

A small number of Sites and Monuments Record (SMR) and National Inventory of Architectural Heritage (NIAH) entries are in the surrounding agricultural landscape, primarily to the east and south-east of the site. Reference WM04021 and WM01799 relate to the remains of a ecclesiastical structure and church on the eastern hillslope of the site. WM01796 is a Barrow - mound barrow and WM01795 is a burial mound.

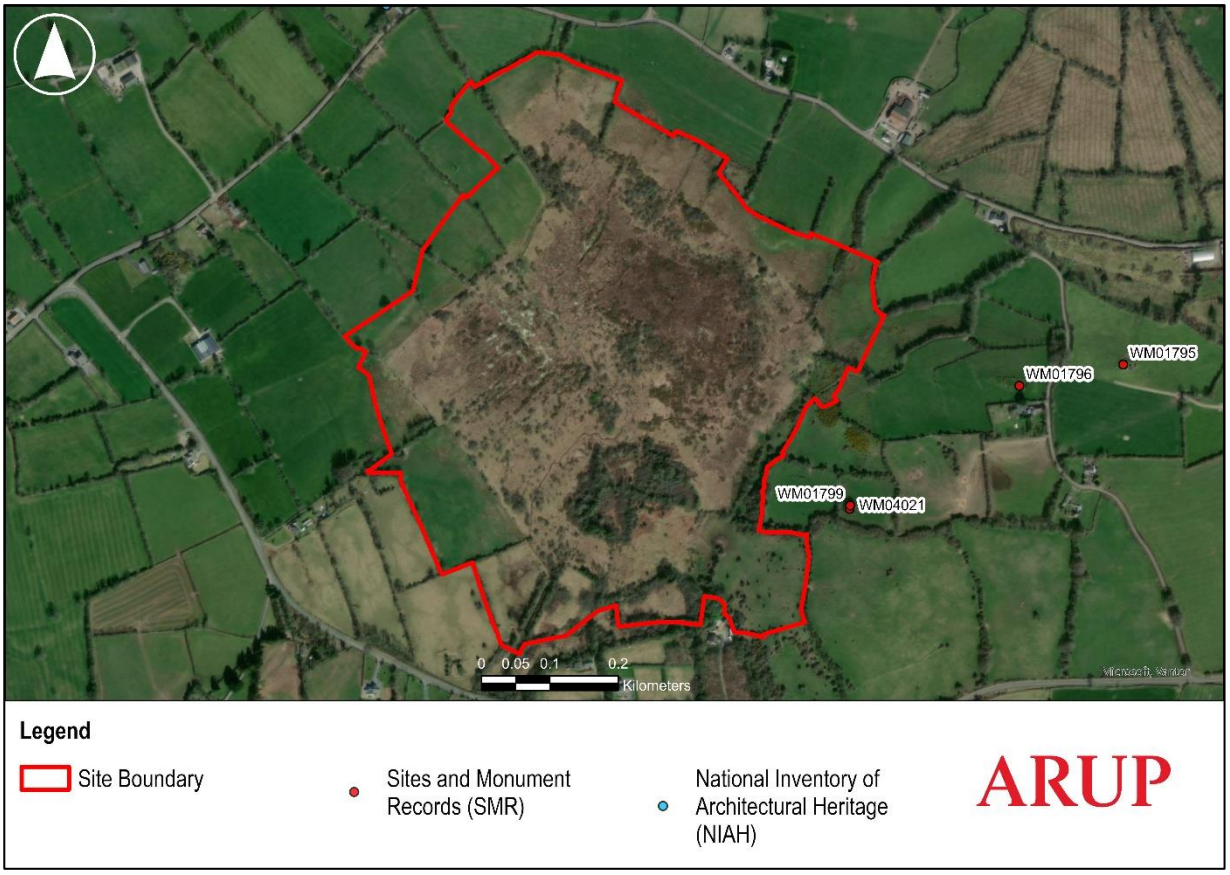


Figure 7-2: Archaeological Sites for Ballymore Fen SAC (NMS, 2025)

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 Ballymore Fen are under Commonage ownership by private individuals
	FENCES (EPA, Trinity College Dublin, NPWS)	Interdisciplinary research is being conducted within Ballymore Fen to understand fen ecohydrology, nutrient cycling, and carbon dynamics. Need to ensure long-term alignment and engagement with researchers.
Off-site	OPW	Arterial drain to the south and north of the site. Engagement with OPW to implement a drainage plan
	LAWPRO	Ballymore fen is within a LAWPRO Prioritised Areas for Action
	Landowners & farmers	Engagement for uptake of catchment measures.
Capacity building	NPWS	NPWS engaging in community education and events

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

Table 8-2: Implementation plan for Ballymore Fen SAC 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 Ballymore Fen SAC. 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	Westmeath Co. Co	Arup	NPWS
1.2	**Drainage management plan**							
	Consultation with OPW on the drainage management plan is required to ensure compliance with legislation and local authority objectives.	Sitewide	Drainage management plan	Pre-restoration	NPWS	Westmeath 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	Westmeath 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. The ecologist will confirm/mark up the areas of scrub required for removal.	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 drain blocking to the south-east The 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.	Southeastern small drain	Site installation records	Restoration in 2026	NPWS to facilitate site access		Arup / Contractor	Within Tóchar project scope
3.2	**Nutrient measures**							
	Source control within site boundary Engage landowners to reduce nutrient application within site boundary through farmer training and nutrient management plan specific to fen.	Sitewide	Nutrients (Nitrate and phosphate), EC, pH	Restoration in 2026	NPWS to facilitate site access		Arup / Contractor	Within Tóchar project scope
	Pathway interception within site boundary Ensure all drains have a riparian buffer along the farm side. Establish or maintain hedgerows along the site boundary and within the site boundary	Sitewide	Nutrients (Nitrate and phosphate), EC, pH	Restoration in 2026	NPWS to facilitate site access		Arup / Contractor	Within Tóchar project scope
3.3	**Vegetation measures**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	Proposed measures to address vegetation succession and invasive alien species include: 1. Removal of invasive alien species (rhododendron and cherry laurel) 2. Monitoring of vegetation cover and diversity (native species) 3. Removal of scrub (single beech tree) via hand tools (chainsaw)	Sitewide	Site records / habitat surveys	Restoration 2026	NPWS		Arup / Contractor	Within Tóchar project scope
4	**Off-Site Restoration measures**							
4.1	**Hydrology measures**							
	Avoid creating new drainage channels adjacent to the site Landowners engaged about avoiding creating new drainage channels.	Upstream farms	Surface water	Long-term	NPWS		Landowner	
	Arterial drainage management plan Engage with OPW on the management of arterial drainage channels to the north and south.	North and south arterial drains	Surface water	Long-term	NPWS/OPW			
4.2	**Nutrient measures**							
	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	

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	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
5	**Monitoring progress**							
5.1	**Hydrology monitoring**							
	Groundwater and surface water 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	Water level	Long-term	NPWS		FENCES	NPWS
	Rainfall and evaporation monitoring using site-specific or nearby stations.	Sitewide	Rainfall and evaporation levels	Long-term	NPWS		FENCES	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		FENCES	NPWS
5.3	**Vegetation monitoring**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	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		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		Long-term	NPWS/ Farming for Water EIP / LAWPRO / Teagasc			Farming for Water EIP / other similar

8.1 Habitats Benefiting from Implementation of Restoration Actions

7140 Transition mires / PF3 / FS3 / FS1

The proposed restoration measures will maintain the open, wet conditions that are fundamental to this habitat's ecological integrity. Vegetation monitoring will allow early detection of scrub encroachment and species shifts, while hydrological monitoring ensures that water levels remain suitable for the delicate mire system.

7230 Alkaline fens / PF1 / FS3 / FS1

The benefits of restoration actions lie in maintaining hydrological balance and controlling nutrient inputs. Regular monitoring of vegetation and water levels will ensure that alkaline fen communities remain stable and resilient to pressures such as eutrophication and atmospheric deposition.

8.2 Species Benefiting from Implementation of Restoration Actions

The species recorded within the site (Section 4.1.2) will benefit from restoration actions that favour the condition of habitats that support them. Through continued ecological and hydrological monitoring, appropriate maintenance and any new future measures can be identified to align with conservation objectives of the site.

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Appendix A – Non-Technical Summary

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan Non-Technical Summary			
Site Name	Ballymore Fen	**NFS site no.**	104011
County	Westmeath	**Designation**	SAC
Fen habitats present (area)	7140 Transition mire 7230 Alkaline fen		

Site Description

Ballymore Fen is located 17k m west of Mullingar, Co. Westmeath and has been designated as a Special Area of Conservation (SAC) for the presence of 7140 Transition mire listed under Annex I and II of the EU Habitats Directive. The transition mire habitat covers the northeastern section of the site as well as the southern to central belt. The remainder of the site is represented by areas of Annex I quality 7230 Alkaline fens, however, these are not designating features of the site as well as non-Annex I habitat including dry calcareous and neutral grassland, wet grassland and improved agricultural grassland

Conceptual Site Model (CSM)

Ballymore fen occurs at around 90m OD and occupies a flat, low-lying basin surrounded by higher ground. The site is underlain by karstified Waulsortian Limestone, forming a Locally Important aquifer that is moderately productive in shallow weathered and fractured zones. Overlying sediments include limestone derived till, with localised alluvial and lacustrine deposits, reflecting glacial and post glacial development. Peat deposits are deeper towards the centre of the site and thinner towards the site boundary.

The fen receives water supply from rainfall, springs and groundwater, with groundwater dominant in summer and surface water dominant in winter. Despite seasonal changes in inflows and outflows, surface water levels remain relatively stable. Groundwater–surface water interactions within the peat include both downward recharge and localised upwelling, leading to internal circulation. The fen functions as a natural nutrient buffer, with lower nutrient concentrations than the surrounding catchment and particularly low dissolved reactive phosphorus levels at the outlet during winter, reflecting dilution and attenuation processes.

The centre of the site represents WETMEC 9a: Wet Groundwater-Fed Bottom. The natural fen stream is seasonally active and more dominant in the winter according to previous studies. Nutrient levels are low. The areas of the site to the north and south represent WETMEC 9b: Part-Drained Groundwater Bottom under the influence of historical and current drainage. Drains towards the south had very high nitrate and high phosphate levels during site surveys.

There are two springs along the western border of the site representing WETMEC 16a: Groundwater-Flushed Bottom which discharge directly to the site without an associated watercourse. Peat is generally thin and according to previous studies dissolved reactive phosphorus levels are high. There is one spring along the western boundary of the site which

is connected to a drainage channel. Peat is generally thin. Nitrate was low but phosphate was high during site surveys.	
Key Pressures	
Hydrology Pressures	• Drainage has not been identified as a key pressure. One drain located within the habitat to the south shows localised impacts and has been highlighted as pressures requiring targeted management.
Nutrient Pressures	• Diffuse pollution from agricultural activities presents nutrient pressure on the fen habitat. Land use in the surrounding areas, specifically in the southwest, is contributing to nutrient enrichment and eutrophication.
Ecology Pressures	• Invasive non-native alien species - reconfirmed the presence of two cherry laurel patches • Drainage - an unmapped drain at the south side of the site is infilling with bulrush and bottle sedge. It is bounded by gorse and willow scrub, indicating at least a local drawdown effect. • Scrub encroachment a single 3.5m tall beech tree was recorded between the cherry laurel.
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 7140 Transition mires or improve the hydrological conditions that will allow an expansion of the measurable area of Annex I quality 7230 Alkaline, 7120 Degraded raised bogs and non-annex fen habitats, thus impacting on Site Specific Conservation Objectives (SSCOs)/favourable condition of the site.	
Restoration Measures	
Hydrology Measures	**On-Site Measures:** Small drain blocking to the south-east **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	**On-Site Measures:** Source control within site boundary; Pathway interception within site boundary

	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:** Removal of invasive alien species (rhododendron and cherry laurel); Monitoring of vegetation cover and diversity (native species); Removal of scrub (single beech tree) via hand tools (chainsaw)
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/	

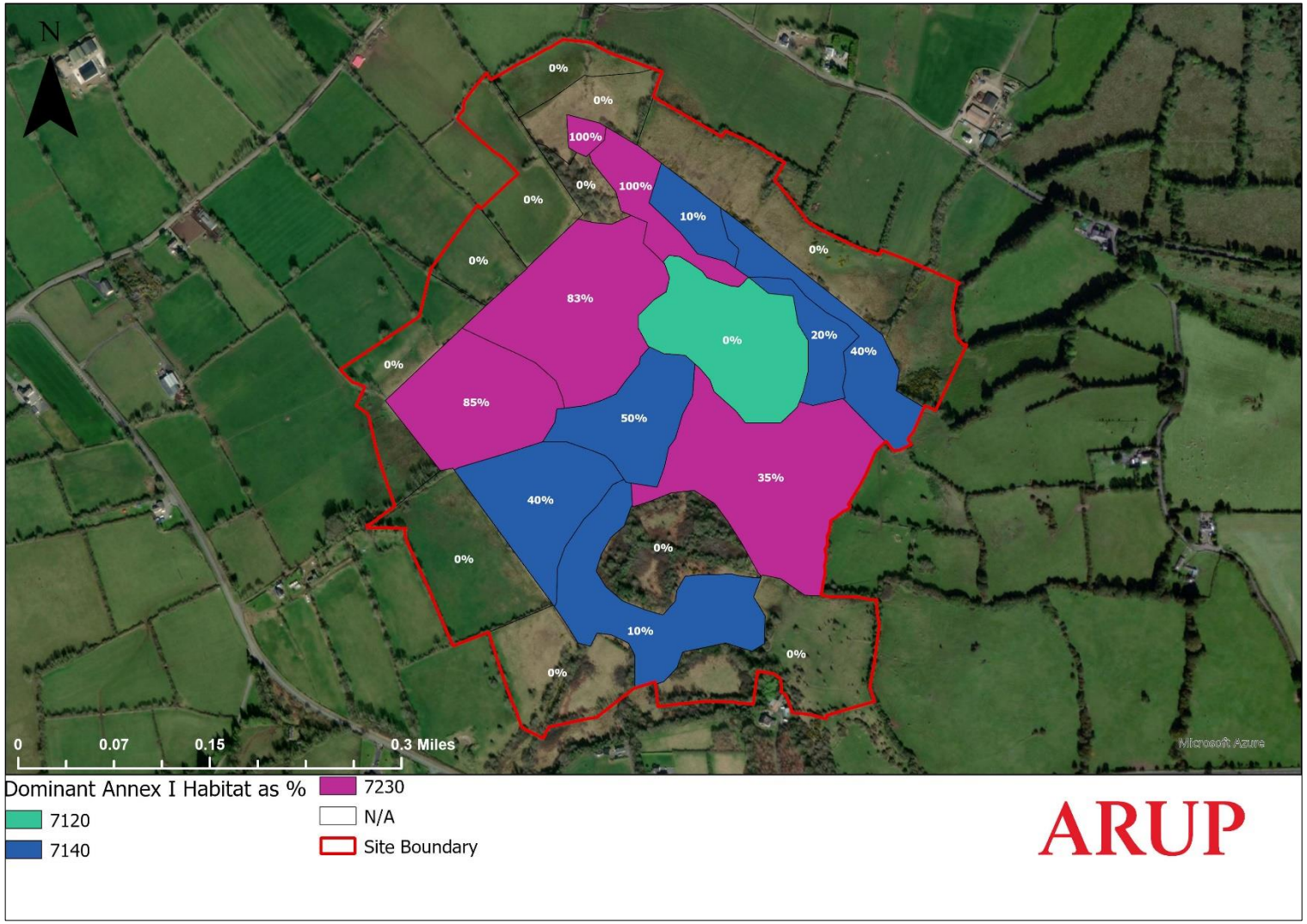


Figure 1: Site Habitat Map

Ballymore Fen SAC
Westmeath County
Upper Shannon: MULLENMEEHAN STREAM_010, RATH_020
GW fed bottom (WETMEC 9) with GW flushed bottom (WETMEC 16)

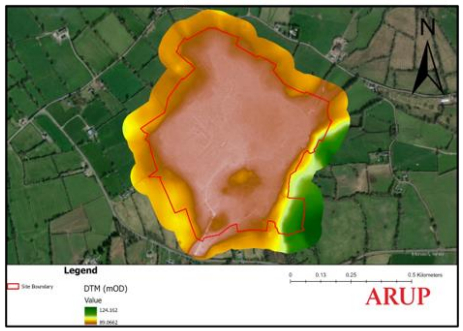
Water key:

Fen stream
Seasonal springs
Seasonal drains
Wetland vegetation

Cross section:



Location:



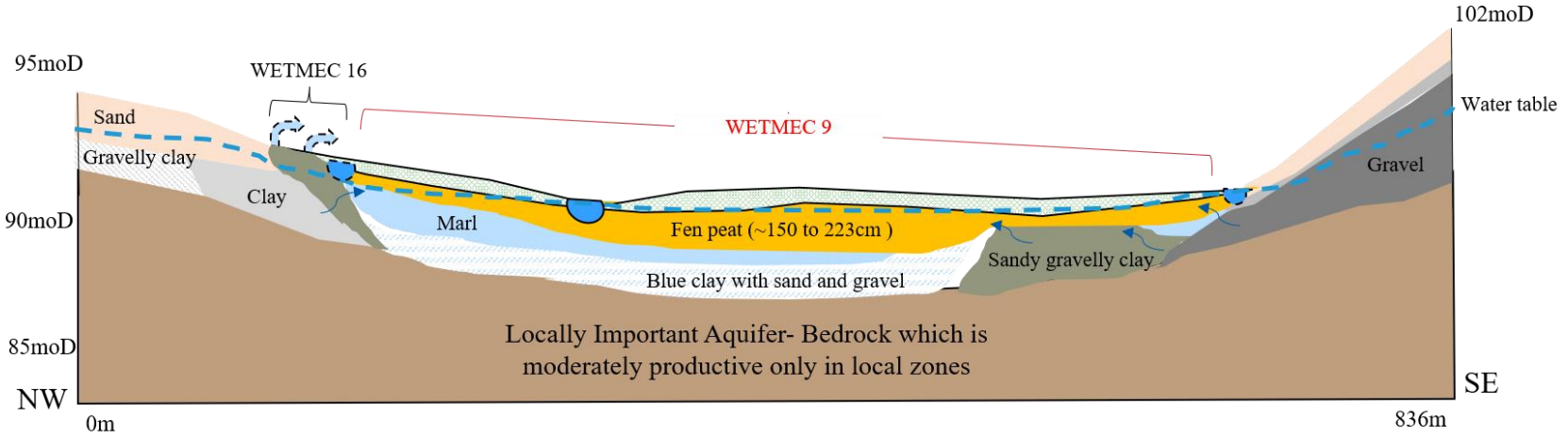


Figure 2: Conceptual Site Model

Appendix B – Ecological Survey Maps

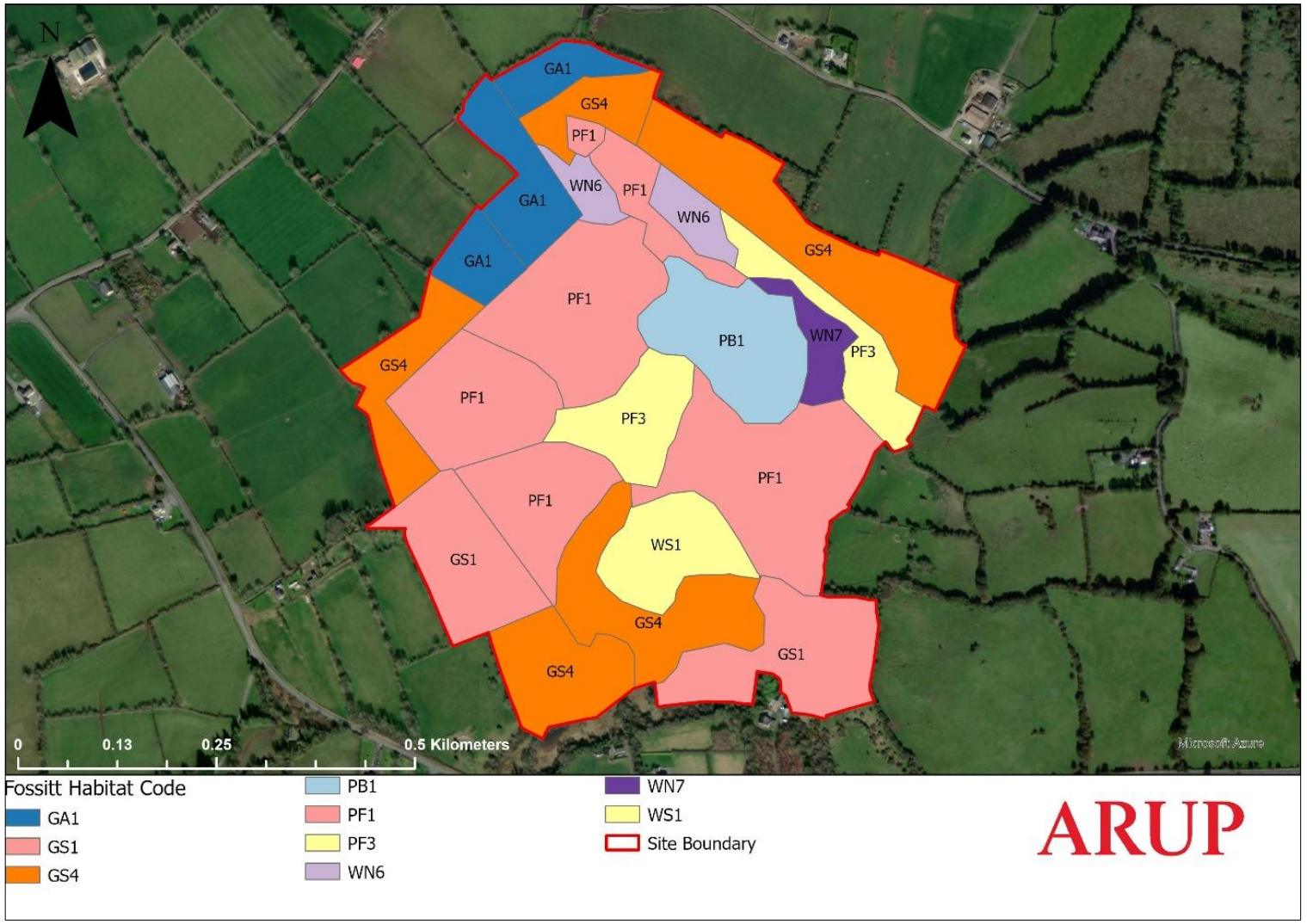


Figure B-1: Habitats recorded during the 2023 NFS and classified according to the Fossitt Habitat Classification System

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
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

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
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
		EU1	Non-marine caves
		EU2	Artificial underground habitats
		ED1	Exposed sand, gravel or till
		ED2	Spoil and bare ground
		ED3	Recolonising bare ground

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
		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

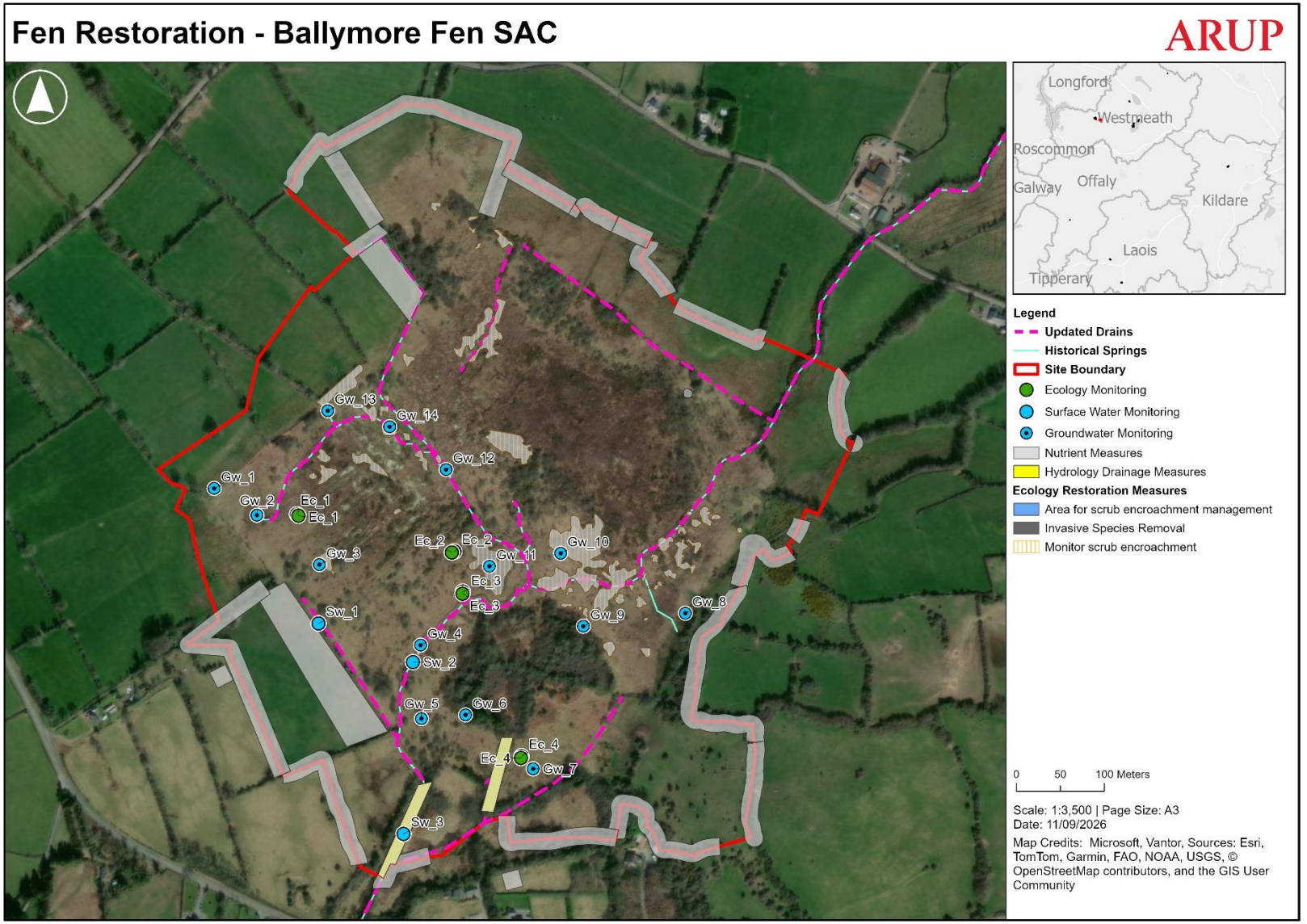


Figure C1: Restoration and monitoring for Ballymore Fen

Table C1: Long-term monitoring points for fen restoration at Ballymore Fen SAC

Point	Measure	Objective	Timeframe	Frequency of monitoring	Monitoring indicator
Gw_1	Hydrological	Monitoring groundwater levels and quality	Long-term	Seasonal[9] 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
Gw_6					Groundwater level
Gw_7					Groundwater level
Gw_8					Groundwater level
Gw_9					Groundwater level
Gw_10					Groundwater level
Gw_11					Groundwater level
Gw_12					Groundwater level
Gw_13					Groundwater level

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

Point	Measure	Objective	Timeframe	Frequency of monitoring	Monitoring indicator
Gw_14		Monitoring of surface water levels and quality	Long-term	Seasonal for year 1 Annual for year 2-5	Groundwater level
Sw_1					Water level and quality at open water drain
Sw_2					Water level and quality at open water drain
Sw_3					Water level and quality at main outflow of Mullenmeehan Stream

Appendix D – Drainage Management Plan

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan: Drainage Management Plan			
Site name	Ballymore Fen		
County	Westmeath	**NFS site No.**	104011
Catchment overview:			
Ballymore Fen SAC is located 17 km north-west of Mullingar, County Westmeath. Ground elevations across the site range between approximately 90 mOD and 117 mOD. The fen is located at the lowest point within the local topography, at approximately 90 mOD, with surrounding areas characterised by gently elevated terrain in the order of 95–96 mOD, rising to higher ground at approximately 117 mOD. Land use on the surrounding hillslopes is agricultural.			
WFD catchment	Upper Shannon (26F)	**WFD Sub-catchment**	Inny [Shannon]_SC_070 and Inny [Shannon]_SC_09
Drainage Area	Inny: C12/8 and C8/7/3	**Drainage District**	No
Responsible authority	OPW	**Maintenance date**	Road/culvert upgrade in 2021
Surrounding landowners	Private		
Wetland drainage			
The site is positioned at approximately 90m OD and is within a depression with higher ground on surrounding hillslopes. The site is relatively flat within the centre, although there is a raised 'island' to the south. Past peat cutting to the north has led to development of extensive fen pools in the north-west of the site. Seasonal variation in surface water flow is evident within the fen. In winter, surface water flows from the north-west and east towards the fen's natural stream, discharging to the OPW drain to the south. In summer, the lowest water levels occur in the central area of the fen to the north-east of the stream, with flow directed towards the south-eastern boundary; however, field observations indicate that this flow reconnects with the natural stream via a small ditch. Overall, surface water levels show limited seasonal change. An assessment of historical and current hydrological data indicates that the water regime of Ballymore Fen has changed over time, primarily due to drainage for peat extraction activities. Springs located at the west boundary of the site, feed the surface water drainage system. These springs can be seen in historical maps from the early-1800s. The main drainage feature in Ballymore Fen is the arterial drain to the south and the arterial drain to the north. There are historical drains to the south-east and south-west which both drain towards the			

arterial drain in the south. There may be drainage to the north directed towards the northern drain, but it is less active than the southern drain. The springs to the west also have natural drainage towards the more natural fen stream. The spring in the north-west has a more modified drain directing flow towards the fen stream.

Surface water inflow	Springs to the west	**Surface water outflow**	To the north drains to Rath River; to the south drains to Dungolman River. Both drain towards Lough Ree.
Groundwater inflow	Close connection to groundwater within the centre of the wetland.		
Internal drains	Yes (south)	**Perimeter drains**	No

On site hydrology measures

Small drain blocking to the south-east

The 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.

Off-site hydrology measures

Off-site measure 1	Avoid creating new drainage channels adjacent to the site	**Role player**	Landowners

Landowners engaged about avoiding creating new drainage channels.

Off-site measure 2	Arterial drainage management plan	**Role player**	OPW

Engage with OPW on the management of arterial drainage channels to the north and south.

On-site nutrient measures

On-site measure 1	Source control and pathway interception within site boundary	**Role player**	Landowners, NPWS

Engage landowners to reduce nutrient application within site boundary through farmer training and nutrient management plan specific to fen.

<table>
<tr><th colspan="6">NPWS Tóchar Midlands Wetland Restoration Scheme
Fen Restoration Plan: Drainage Management Plan</th></tr>
<tr><td colspan="6">Ensure all drains have a riparian buffer along the farm side. Establish or maintain hedgerows along the site boundary and within the site boundary</td></tr>
<tr><td colspan="2">Off-site measure 1</td><td colspan="2">Agricultural and catchment nutrient management</td><td>Role player</td><td>Landowners, NPWS</td></tr>
<tr><td colspan="6">Promote livestock drinking point where appropriate and excluding livestock from fen for water supply.</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="6">Water Monitoring</td></tr>
<tr><td>Indicator</td><td>Water level</td><td>Location</td><td>Various locations across site</td><td>Role players</td><td>NPWS</td></tr>
<tr><td colspan="6">Groundwater and surface water 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.

Rainfall and evaporation monitoring is proposed using the nearby Met Eireann weather station.</td></tr>
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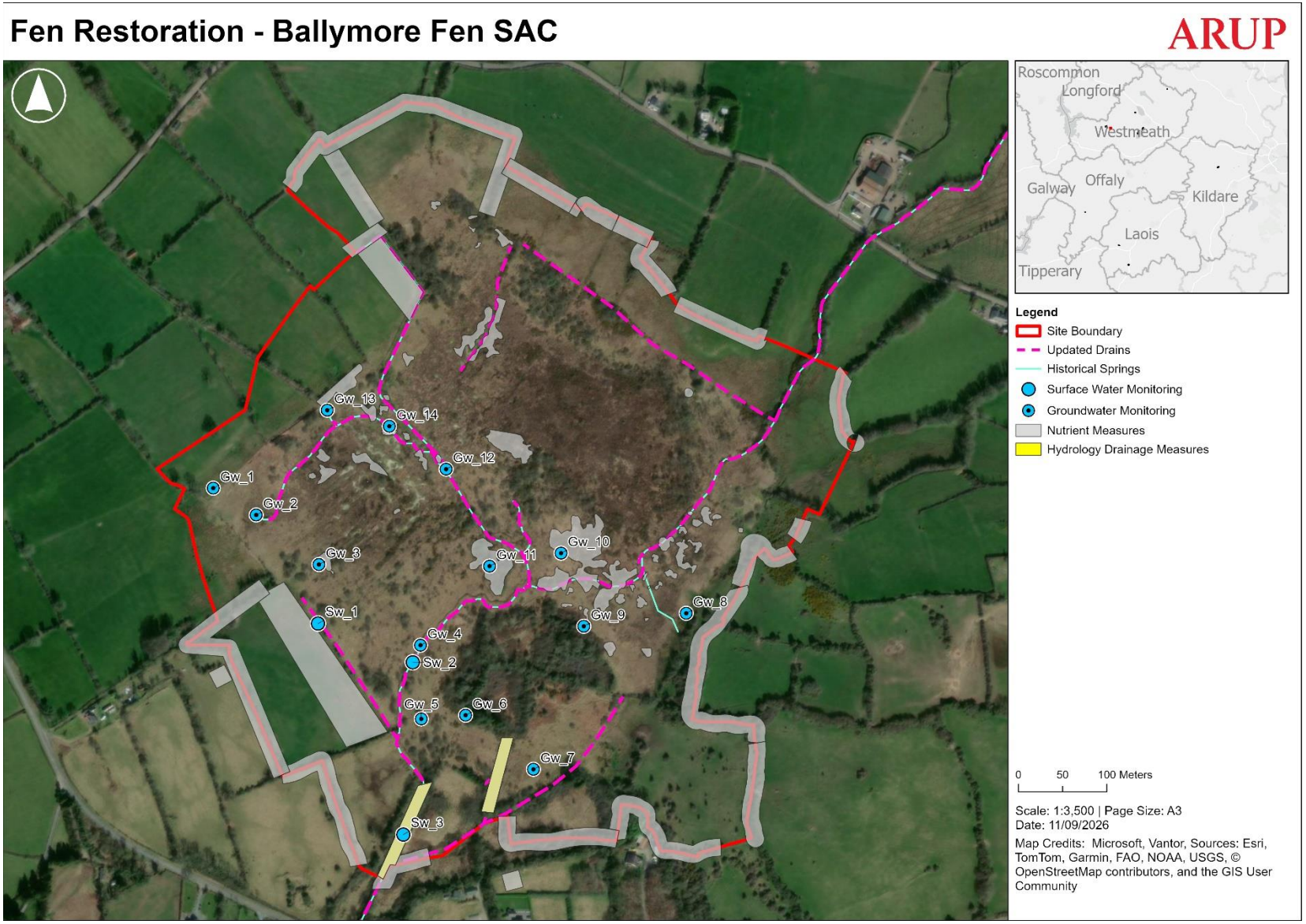


Figure 1: Hydrology measures and monitoring at Ballymore Fen