

National Parks & Wildlife Service

Sheheree (Ardagh) Bog SAC (Site code 000382)



Raised Bog Restoration Plan

Version 2a

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1 Introduction

1.1 Purpose of the Restoration Plan

This restoration plan has been developed by National Parks and Wildlife Service (NPWS) of the Department of Housing, Local Government and Heritage to set out proposals for restoration of raised bog and associated habitats at Sheheree (Ardagh) Bog Special Area of Conservation (SAC) (000382). This plan identifies technically feasible restoration measures for the various zones of the bog including the high bog, cutover bog and surrounding margins and provides details of progress on implementation of their restoration plans.

The restoration measures set out will enable nature conservation targets for Active Raised Bog (ARB) at this SAC to be met. Although the focus of the restoration plan is on ARB habitat, it is anticipated that restoration measures will also benefit other peatland habitats and can contribute to socio-economic benefits for the local community, improvements to biodiversity and reduced carbon emissions. Monitoring of this restoration plan will be undertaken to ensure that the intended restoration measures are successfully contributing to the achievement of the site-specific targets for ARB at Sheheree Bog SAC.

Action 1.1: Develop restoration plan further in partnership with stakeholders.

This plan will be developed further in conjunction with stakeholders to ensure that restoration is carried out in such a way that the conservation requirements of the site can be met, whilst minimising any impacts on adjacent land and maximising benefits to the local community. The plan will develop and change over time through input from stakeholders and will be considered a living document. The primary aim of this restoration plan is to ensure site-specific conservation objectives for Sheheree Bog SAC can be met.

Section 2 of the restoration plan sets out the restoration measures that have been proposed for Sheheree Bog. Section 3 outlines how the need for a drainage management plan for Sheheree Bog has been investigated as part of this restoration plan. Section 4 describes potential for community benefits to be explored and section 5 outlines progress with implementation of the plan.

Map 1 outlines the location and extent of Sheheree (Ardagh) Bog SAC. Map 2 illustrates restoration measures that have been implemented to date as well as any proposed/outstanding restoration measures to be implemented at Sheheree Bog. This document provides an outline of the restoration plan but is supported by detailed datasets that are available on the NPWS Restoration Maps Viewer. This map viewer provides NPWS with an up-to-date view of all restoration plan details and supporting information including status of landowner investigations, landowner consent, progress with construction and details of proposed and remaining restoration measures.

1.2 Sheheree (Ardagh) Bog SAC

Sheheree Bog (SAC) lies 2km south-east of Killarney in Co. Kerry, in a depression within a high ridge (103mASL). It has developed by succession from a small lake to a ridge basin bog with similarities to a raised bog. The SAC includes the raised bog and surrounding areas of wet lagg vegetation along the margins of the bog and dry grassland fields which slope down to, and adjoin the bog. The bog is rather unique in an Irish context as it is the only raised bog system to be completely surrounded by a wet lagg zone.

The SAC has been selected for two Annex I habitats. These are:

- [7110] Active raised bogs*
- [7120] Degraded raised bogs still capable of natural regeneration

*Priority habitats

This restoration plan has been developed to address restoration measures for these peatland habitats.

The margins of the site remain relatively undisturbed. The high bog is being invaded by *Rhododendron ponticum* and *Pinus sylvestris*, which may indicate drying of the bog. Cattle grazing has also been occurring on the high bog in recent years (Patrick Crushell, pers. comm.). Adjoining fields are grazed by cattle and sheep and fertilised to varying degrees. Land use practices here may impact on the bog habitat. In addition, there is evidence of significant usage of the site by deer which is likely to be having an adverse impact on the bog.

Sheheree Bog is of high conservation importance as it contains good examples of ARB and DRB. Of particular note is that it is the only remaining raised bog in the country with an intact surrounding lagg system, and this makes it of especially high ecological interest. In addition, the site is the most south-westerly example of a raised bog in the country and is one of only two examples of the habitat in Co. Kerry. The presence of the protected (Flora (Protection) Order, 1999) plant species *Eriophorum gracile*, which is only known from approximately 25 sites in Ireland, adds to the conservation value of the site. The small size of this bog, coupled with the fact that it is a Nature Reserve, are positive factors for the future conservation of the site.

1.3 Site-specific conservation objectives

Detailed site-specific conservation objectives (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 Sheheree (Ardagh) Bog SAC for ARB habitat using attributes and targets based on parameters set out in the Habitats Directive. In summary, one of the key targets is to restore the area of ARB to 4.9 ha. The area of ARB was reported as 4.1 ha during the latest monitoring survey (2012) and it has been determined that there is potential for 0.8 ha of Degraded Raised Bog (DRB) to be restored to ARB on the high bog following restoration measures. Unlike on other larger raised bogs, there is no cutover surrounding Sheheree Bog and therefore there is no potential for restoration of ARB in marginal areas as there is already wet lagg vegetation. Several targets have been set for other attributes relating to the quality and condition of ARB habitat, including a target to restore adequate transitional areas to support/protect the active raised bog and the ecosystem services it provides. The restoration measures proposed by this restoration plan aim to achieve these targets. Further information on the SSCO's can be found in the Sheheree (Ardagh) Bog SAC conservation objectives document (NPWS, 2015a) and the conservation objectives supporting document – raised bog habitats (NPWS, 2015b).

2 Restoration measures at Sheheree (Ardagh) Bog SAC

2.1 Introduction

Hydrological processes are key drivers of raised bog ecology, as raised bogs are predominately fed by precipitation. For ARB to develop or be maintained, mean water levels need to be near or at the bog's surface for most of the year. Seasonal fluctuations should not exceed 20cm below ground surface, and water levels in the peat should be within 10cm of the surface, except for very short periods of time (Kelly & Schouten 2002). Gentle slopes that limit intermittent lateral losses of water (through surface run-off) and encourage sustained water-logging are the most favourable to achieve these conditions. These conditions may be maintained on steeper slopes in areas of focused flow (flushes) (Mackin et al., 2017a; Regan et al 2020). However, it will not be possible to raise the water

level to high enough levels across the entire high bog surface, particularly approaching marginal areas, to enable ARB to develop. Even in high bog areas that do not have potential for ARB to form, water levels should be raised as necessary to support habitat for the areas where ARB can occur.

The main aim of restoration on raised bogs is to maintain or improve the quality of existing areas of ARB or improve the hydrological conditions that will allow ARB to develop in areas with suitable topographic conditions (gentle slopes and/or areas of focused flow). This requires measures to be implemented on both the high bog and cutover areas. Measures implemented on selected areas of cutover will also help to minimise the impact that drainage and cutting has had on the hydrological integrity of the high bog and support a diversity of other transitional wetland habitats (e.g. wet woodland and fen), as well as the species they sustain. Once restored, these transitional cutover zones may provide further ecosystem services through flood attenuation and water supply maintenance and purification, increased carbon sequestration and improvements to the site's overall biodiversity value.

The main restoration measures that may be considered for improving hydrological conditions on raised bogs include:

- Drain blocking (includes drains on both high bog and the margins)
- Removal of forestry/tree clearance
- Installation of marginal dams
- High bog excavation/re-profiling
- Inoculation with *Sphagnum* species
- Bunding on high bog or cutover bog

Further details on each of these measures can be found in Irish Wildlife Manual No. 99 'Best practice in raised bog restoration in Ireland (Mackin et al., 2017b). Additional measures may be considered in particular instances where there are specific problems that are causing damage to an SAC. The most relevant restoration measures for Sheheree (Ardagh) Bog SAC are outlined in Section 2.2 – 2.6 below.

2.2 Blocking of high bog drains

Sheheree Bog is unusual as there has been no turf-cutting at the site and the bog remains relatively intact. The most recent monitoring survey in 2012 did not record any high bog drains impacting on the high bog or surrounding lagg. No drains were detected through the use of LiDAR and high resolution aerial imagery. However, there are some linear patterns on the high bog that may be associated with old high bog drainage. These drains may have infilled and are not evident from field surveys; however, a hydrological survey should be carried out as although these drains may be heavily infilled they may act as preferential flow paths on the high bog.

Action 2.1: Investigate whether there are any functional high bog drains on Sheheree Bog.

Recent ecological surveys have reported that there are no drains on Sheheree Bog. However, there are some linear patterns visible on aerial images that may be associated with old high bog drainage. A hydrological survey should be carried out as these may be preferential flow paths on the high bog.

2.3 Control of invasive species

The spread of *Rhododendron ponticum* on the high bog was reported by Fernandez et al. (2014) as impacting on the site. It is notably more common and widespread along parts of the high bog margin, where it appears to be spreading from the adjacent lagg wood/scrub. It is also more common in the northern half of the high bog, particularly in the north and east of this area. It is as yet uncommon in the bog woodland, but is more frequent in the adjacent flush scrub.

Fernandez et al. (2014) noted that it was unclear if *Rhododendron* has become more abundant since the 2005 survey (Fernandez et al. 2005), as it was described then as being frequent in the areas in which it is now also common, while several large and mature bushes were scattered over the rest of the bog. Kelly et al. (1995) referred to a site visit by wildlife rangers in 1993, during which the problematic spread of *Rhododendron* was noted.

Action 2.2: Develop site-specific control plan for native-problematic and invasive species Sheheree Bog.

The spread of *Rhododendron ponticum* is impacting on Sheheree Bog. A site-specific plan should be developed to address this problem. This may require actions such as hand-clearance to control the spread of *Rhododendron* or a monitoring programme to determine whether or not *Rhododendron* is becoming more widespread.

2.4 Nutrient management

Sheheree Bog is surrounded by grassland fields which slope down to, and adjoin the bog, as illustrated by Figure 2.1 Photograph of Sheheree Bog indicating presence of fertilised grassland fields sloping down to the margins of the bog. These fields are grazed by cattle and sheep and some are fertilised to varying degrees. In addition, some of the fields permit access for grazing sheep and cattle onto the high bog. Current land use practices are likely to be having an impact on the bog and may need amendment to improve the condition of the site. In addition, deer poaching has been noted as a problem at the site, suggesting a deer fence may be necessary.



Figure 2.1 Photograph of Sheheree Bog indicating presence of fertilised grassland fields sloping down to the margins of the bog

Action 2.3: Investigate potential impacts of agricultural practices in the surrounding margins on Sheheree Bog.

This investigation may require detailed research to determine whether the current land use management practices are impacting on the bog. Application of fertilisers and direct access for grazing animals is likely to increase the nutrient levels both within the wet lagg surrounding the bog and on the high bog itself.

2.5 General site management

In addition to the proposed measures, it is important that the restoration plan contributes to improving general site management. This includes considering issues such as:

- Fire prevention and response
- Management of littering/fly-tipping

Burning of the high bog can result in significant damage to a raised bog by removing peat-forming vegetation which reduces the capacity of the peat to retain water. This causes much more rapid surface run-off and therefore can result in more widespread drying out and increased peak flows in surrounding streams. No recent fires have been reported at Sheheree Bog.

Issues such as littering and fly-tipping are common at many raised bogs. Depending on the nature of the material dumped this can lead to pollution in surrounding areas. This is unlikely to be an issue at Sheheree Bog but may become an issue if access to the site is increased in future.

Action 2.4: Prepare a fire prevention and control plan for Sheheree Bog in consultation with local stakeholders.

It is proposed that a fire prevention plan is developed for Sheheree Bog to identify past occurrences of fires, the likely causes and develop an effective plan to prevent fires in future as well as an appropriate response should a fire occur in the future. Issues such as fire prevention and management of littering/fly-tipping also need to be addressed as part of a wider strategy of raising public awareness on the importance of these habitats.

3 Drainage Management Plan

One issue that can cause concerns, particularly for local stakeholders, relates to whether restoration may result in increased flooding in the surrounding area. As widespread drain blocking is not required at Sheheree Bog, there is limited need for measures to be implemented through a Drainage Management Plan. An integrated drainage management plan for the bog and its surroundings has been developed as part of this restoration plan. The drainage management plan is intended to support the conservation objectives for Sheheree Bog SAC by ensuring the drainage network can be maintained without impacting on the conservation objectives. The plan assesses instances of existing impediments to the effective management of the drainage network (e.g. undersized culverts or channels) and provides recommendations in relation to remedial works and maintenance works going forward. Implementation of such measures will ensure that the risk of flooding will be significantly reduced.

Action 3.1: Implement the actions of the Drainage Management Plan for Sheheree Bog SAC in conjunction with local stakeholders.

Implementing this plan will require input from local stakeholders to ensure that actions can be completed

4 Community Benefits

Through consultation with the local community and other stakeholders it will be possible to develop ideas for maximising socio-economic benefits for the local community through restoration. These might include building or improving existing facilities, where appropriate (i.e., tracks, board walks, bog bridges), encouraging the creation of small tourism enterprises, promoting the benefits to human health and well-being and enhancing the value of the site as an educational resource. There are many cases where local communities, including local businesses, are actively involved in or supporting the conservation and restoration of raised bogs across the country. Examples of this are found at Abbeyleix Bog (Co. Laois), Carrownagappul Bog SAC (Co. Galway), Girley Bog Natural Heritage Area (NHA) (Co. Meath), Lodge Bog (Co. Kildare) and Scohaboy Bog NHA (Co. Tipperary).

Sheheree Bog offers potential for recreation and amenity; particularly due to the location of the bog in close proximity to Killarney town. Currently it is possible to access the bog through agricultural land on the eastern side of the bog. There is potential for sensitive amenity use in this area; however, any proposed amenity facilities will need to be implemented in a way that does not impact on the site-specific conservation objectives for the site.

Apart from immediate economic benefits, the restoration of raised bogs can provide many other benefits to the wider community, such as provision of clean water, flood attenuation and water flow regulation, preservation of archaeological artefacts and other sources of historical knowledge and, not least, helping Ireland reduce its national greenhouse gas emissions and, therefore, helping to combat climate change.

Action 4.1: Optimise the community benefits of the restoration plan.

As the restoration plan is further developed and implemented, opportunities to improve the recreation and amenity value of the bog and surrounding areas and promote local initiatives, while protecting and enhancing its natural values, will be explored by and with the local community. Promoting community involvement in the long-term management of the site both during and after restoration measures are carried out, will be encouraged.

5 Restoration Plan Implementation

5.1 Preparatory

Prior to implementation of the restoration plan several preparatory actions are required before construction of restoration measures can commence. A summary of these preparatory actions is outlined below:

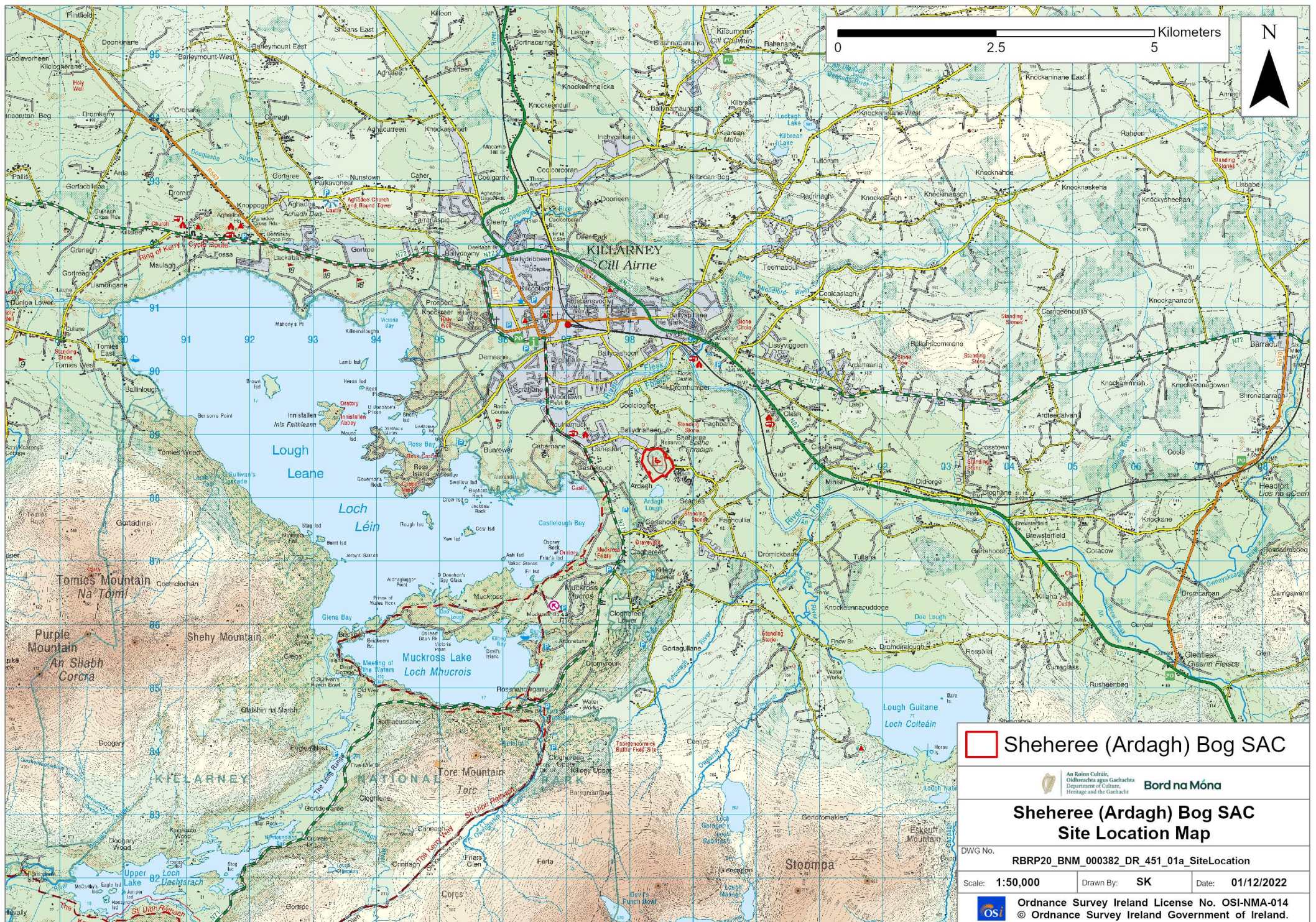
- Hydrological characterisation – collation of existing hydrological data, hydrological surveys, instrumentation with monitoring data (where necessary);
- Review of proposed restoration measures in line with best practice at the time of implementation (including exploring opportunities to implement enhanced measures);
- Detailed ecological surveys (primarily comprising surveys of cutover areas, but where necessary also includes high bog areas e.g., if ecotopes have not been surveyed in many years);
- Landownership Investigations (investigations into ownership, turbary rights etc.);
- Stakeholder consultation and community engagement (meeting with stakeholders to outline restoration plans and consider any concerns raised by the local community);
- Compensation/land acquisition (compensation or acquisition of lands required to implement

the required restoration measures on private lands);

- Appropriate Assessment Screening;
- Compilation of tender/construction documents including preparation of health and safety file;
- Surveying and setting out of the works;
- Implementation of restoration measures (including construction supervision and contract administration);
- Post-works inspections and preparation of as-built survey information;
- Update of restoration plan to outline works completed and remaining works required in future.

5.2 Progress to date

Given there is limited need for extensive restoration measures at this bog, not all of these steps are required for Sheheree Bog SAC. The main requirements include landowner investigations to identify landowners of the bog and adjacent lands. This would then allow consent to be sought for the main actions of invasive management, nutrient management and fencing to be progressed. Further updates will be provided as progress is made with the implementation of the restoration plan.



Map 1_ Sheheree (Ardagh) Bog SAC Site Location

6 References

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Glossary & Acronyms

ACTIVE RAISED BOG (ARB)	Areas of uncut raised bog where the conditions are right for peat to continue to form, and where species of plants and animals typical to intact bogs can thrive. ARB is listed as a priority habitat in Annex I of the Habitats Directive.
ANNEX I	Annex I of the EU Habitats Directive lists natural habitats types of Community interest whose conservation requires the designation of SACs.
ANNEX II	Annex II of the EU Habitats Directive lists animal and plant species of Community interest whose conservation requires the designation of SACs.
BIODIVERSITY	A general term used to describe all aspects of biological diversity including the number of species present in a given environment, the genetic diversity present within a species and the number of different ecosystems present within a given environment.
BOG WOODLAND	Woodland formed on a wet peaty substrate, with permanently high groundwater level. The water is poor in nutrients (ombrotrophic) and the ground surface has high cover of bog moss species, with active peat accumulation taking place. Bog Woodland is listed as a priority habitat in Annex I of the Habitats Directive. It differs from dry woodland on bog where peat accumulation is not taking place.
BUNDING	An impervious embankment of material (peat or other) that provides a barrier to retain water behind it.
CARBON SEQUESTRATION	The capture and long-term storage of atmospheric carbon dioxide, including that accumulated by a bog or fen.
CATCHMENT	An area of land contributing water that drains to a defined point. The term river catchment refers to the area of land that drains into a particular river system and is synonymous with the term drainage basin or watershed.
CUTOVER	Areas of bog that have been previously cut (by hand or by mechanical means), although not down to the underlying inorganic substrate. Cutover areas normally consist of a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.
DEGRADED RAISED BOG (DRB)	The area of high, uncut bog which has been damaged by human activities but which could be restored to active raised bog again through restoration measures within a period of 30 years. It is listed in Annex I of the Habitats Directive.
ECOLOGY	The study of the interactions between organisms, and their physical, chemical and biological environment.
ECOSYSTEM SERVICES	Humankind benefits from a multitude of resources and processes that are supplied by ecosystems. Collectively, these benefits are known as ecosystem services and include products like clean drinking water and processes such as the decomposition of wastes.
EROSION	The processes whereby the materials of the earth's crust are dissolved, or worn away and simultaneously moved from one place to another by natural processes which include weathering, solution, corrosion and transportation.

EVAPOTRANSPIRATION

Water loss to the atmosphere from soil and other surfaces (evaporation) and vegetation (transpiration).

FACEBANK

Areas at the edge of the high bog where peat cutting has taken place. This is an ecotope that is highly degraded and absent of typical *Sphagnum* species.

FAUNA

Animal life.

FAVOURABLE CONSERVATION CONDITION

This is the condition of a habitat or species considered to be favourable at site level. Favourable conservation condition is defined by site-specific conservation objectives (SSCOs). 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.

FAVOURABLE CONSERVATION STATUS

According to the Habitats Directive the conservation status of a natural habitat will be taken as "favourable" when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FLORA

Plant life.

FLOW ATTENUATION

Slowing flow of water out of an area. This is a common method for reducing risk of flood in urban areas whereby diversion channels store water in attenuation ponds. Intact peatlands typically offer natural flow attenuation through slowing flow as a result of higher storage capacity and increased hydraulic roughness, while degraded peatlands are much less effective at attenuating flow as the peat is dried out encouraging overland flow.

HABITAT

Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species' home.

HABITATS DIRECTIVE

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

HEAD

Hydrological term which is a measure of the height to which water can raise itself above an arbitrary given level or datum.

HIGH BOG

The area of bog which has not previously been cut.

HYDROLOGICAL PROCESSES

The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

LAGG

A term used to describe the natural habitat that occurs in the transitional zone between the bog and the mineral soil around a raised bog. Few intact lagg

	zones remain around raised bogs in Ireland as they are typically the first location to be damaged by drainage.
LIDAR	A remote sensing technology that measures vertical surface elevation by illuminating a target with a laser and analysing the reflected light usually obtained using a low-flying aeroplane. This provides detailed information on the surface elevations across an area.
LIFE	An EU financial instrument supporting environmental and nature conservation projects throughout the EU.
MARGINAL DRAIN	Drains on the margins of a raised bog typically on cutover for the purpose of draining spread-grounds to facilitate turf-cutting.
MICROTOPOGRAPHY	Variations in elevation at a relatively small scale. Generally the higher points are no more than a metre higher than the low points, and only a couple of metres across. On a high bog this consists of hummocks, hollows, pools, flats and lawns.
MINEROTROPHIC	Refers to soils and vegetation whose water supply comes mainly from streams or springs. This water has flowed over or through rocks or other minerals, often acquiring dissolved chemicals which raise the nutrient levels and reduce the acidity.
NATURAL HERITAGE AREA (NHA)	These are conservation areas designated for protection under The Wildlife (Amendment) Act 2000. NHAs are considered important for the habitats present or which holds species of plants and animals whose habitat needs protection.
NPWS	National Parks and Wildlife Service.
OMBROTROPHIC	Refers to a type of peatland that receives all of its water and nutrient from precipitation falling directly on its surface.
PIEZOMETER	A piezometer is a device used to measure head. In the case of groundwater a piezometer will provide head at a given point.
PEAT-FORMING HABITAT	These are habitats where peat is actively forming. It includes typical ombrotrophic raised bog vegetation as well as lagg or fen vegetation that indicate that peat is actively forming.
PRIORITY HABITAT	A subset of the habitats listed in Annex I of the EU Habitats Directive. These consist of habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.
RAISED BOG	Rain-fed peatland ecosystems that develop primarily in areas with topographic depressions, where drainage may be impeded by a high groundwater table, or by low permeability of the underlying substrata such as clay. Peat accumulation, over time, elevates the ground surface above surrounding areas to form a raised dome.
RESTORATION ZONE	A specified area within a site where restoration measures have been proposed. Restoration zones have been defined for each raised bog SAC based on factors including hydrological conditions, existing and expected habitats following restoration. This allows restoration measures for each raised bog SAC to be split into manageable units.
SITE-SPECIFIC	

CONSERVATION OBJECTIVE	A site-specific conservation objective aims to define 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.
SPECIAL AREA OF CONSERVATION	Area designated for the conservation of habitats and/or species under the Habitats Directive.
SPREAD-GROUNDS	Area where turf is spread after cutting to dry out, typically drained cutover bog or agricultural areas adjacent to the high bog.
STATUTORY NATURE RESERVE	A Statutory Nature Reserve is an area of nature conservation interest that has been designated by Ministerial Order under the Wildlife Act, 1976.
SUBSIDENCE	Term referring to the sinking of land resulting from natural activity or human activity. Within peat subsidence occurs due to loss of water for example as a result of drainage.
TILL	Geological term referring to unsorted material deposited by glacial ice and showing no stratification. It is often referred to as boulder clay.
TOPOGRAPHY	The arrangement of the physical features of an area.