

# National Parks and Wildlife Service

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## *Conservation Objectives Series*

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### Barnahallia Lough SAC 002118



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Rialtais Áitiúil agus Oidhreachta  
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## Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area 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.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

### Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

## Qualifying Interests

*\* indicates a priority habitat under the Habitats Directive*

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002118 Barnahallia Lough SAC

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1833 Slender Naiad *Najas flexilis*

3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea

## Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: [www.npws.ie/Publications](http://www.npws.ie/Publications)

### NPWS Documents

<b>Year :</b>	2004
<b>Title :</b>	The distribution of <i>Najas flexilis</i> in Ireland 2002-2004
<b>Author :</b>	Roden, C.M.
<b>Series :</b>	Unpublished report to NPWS
<b>Year :</b>	2013
<b>Title :</b>	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation assessments
<b>Year :</b>	2013
<b>Title :</b>	Article 17 assessment form and audit trail for <i>Najas flexilis</i> , the slender naiad (species code 1833). Backing document. April 2013
<b>Author :</b>	O Connor, Á.
<b>Series :</b>	Unpublished report by NPWS
<b>Year :</b>	2015
<b>Title :</b>	Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting
<b>Author :</b>	O Connor, Á.
<b>Series :</b>	Unpublished document by NPWS
<b>Year :</b>	2017
<b>Title :</b>	Ballyhoorisky Point to Fanad Head SAC (site code: 1975) Conservation objectives supporting document- <i>Najas flexilis</i> V1
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation objectives supporting document
<b>Year :</b>	2017
<b>Title :</b>	Mweelrea/Sheeffry/Erriff Complex SAC (site code: 1932) Conservation objectives supporting document- <i>Najas flexilis</i> V1
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation objectives supporting document
<b>Year :</b>	2017
<b>Title :</b>	Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (site code: 365) Conservation objectives supporting document- <i>Najas flexilis</i> V1
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation objectives supporting document
<b>Year :</b>	2019
<b>Title :</b>	The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation assessments
<b>Year :</b>	2019
<b>Title :</b>	The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation assessments
<b>Year :</b>	in prep.
<b>Title :</b>	A study of lakes with Slender Naiad ( <i>Najas flexilis</i> )
<b>Author :</b>	Roden, C.; Murphy, P.; Ryan, J.B.
<b>Series :</b>	Irish Wildlife Manual

## Other References

<b>Year :</b>	2001
<b>Title :</b>	Aquatic plants in Britain and Ireland
<b>Author :</b>	Preston, C.D.; Croft, J.M.
<b>Series :</b>	Harley Books, Colchester
<hr/>	
<b>Year :</b>	2004
<b>Title :</b>	The ecology of <i>Najas flexilis</i>
<b>Author :</b>	Wingfield, R.A.; Murphy, K.J.; Hollingsworth, P.; Gaywood, M.J.
<b>Series :</b>	Scottish Natural Heritage Commissioned Report No. 017 (ROAME No. F98PA02)
<hr/>	
<b>Year :</b>	2016
<b>Title :</b>	A narrative for conserving freshwater and wetland habitats in England
<b>Author :</b>	Mainstone, C.; Hall, R.; Diack, I.
<b>Series :</b>	Natural England Research Reports Number 064
<hr/>	
<b>Year :</b>	2020
<b>Title :</b>	Slender Naiad ( <i>Najas flexilis</i> ) habitat quality assessment
<b>Author :</b>	Gunn, I.D.M.; Carvalho, L.
<b>Series :</b>	CRW2018_27. Scotland's Centre of Expertise for Waters (CREW)
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## Spatial data sources

**Year :** 2008

**Title :** OSi 1:5000 IG vector dataset

**GIS Operations :** WaterPolygons feature class clipped to the SAC boundary. Expert opinion used to identify Annex I habitat and to resolve any issues arising

**Used For :** 3130 (map 2)

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## Conservation Objectives for : Barnahallia Lough SAC [002118]

### 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea

To maintain the favourable conservation condition of Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea in Barnahallia Lough SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Lake habitat 3130 is found in Barnahallia Lough. See map 2. The habitat occurs in clear-water lakes of intermediate alkalinity where <i>Isoetes lacustris</i> and <i>Potamogeton perfoliatus/praelongus</i> co-occur and is characterised by high species-richness and a deep-water flora that can include <i>Najas flexilis</i> (Roden et al., in prep.). The habitat was in poor deteriorating conservation status across Ireland in the two reporting periods, 2007-2018 (NPWS, 2008, 2013, 2019). The majority of lakes with 3130 appear to be damaged and high conservation value 3130 lakes in good condition are extremely rare (Roden et al., in prep.). The lake surface area is the simplest measure of extent and should be stable or increasing. For further information on all attributes and an overview of Slender Naiad type lakes see Roden et al. (in prep.). See also O Connor (2015)
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 2	Barnahallia Lough is a small, deep, lake on the Lakes Marble formation (Dalradian) in what appears to be a low-altitude corrie (Roden, 2004). <i>Najas flexilis</i> was first recorded in Barnahallia by M.J.P. Scannell in 1975. Barnahallia was last surveyed in 2004 (Roden, 2004), and the current conservation condition of lake habitat 3130 is unknown
Vegetation species richness	Occurrence	Maintain appropriate species richness	A diverse flora was recorded at Barnahallia in July 2004 when c.14 species were recorded (Roden, 2004). There should be no decline in species richness (see Roden et al., in prep.). Roden et al. (in prep.) found that lake habitat 3130 has a varied and species-rich flora, with high conservation value examples having >30 species of aquatic macrophytes. Almost all lakes with more than 30 species had euphotic depth >3m (Roden et al., in prep.). The number of species recorded increases with sampling effort (Roden et al., in prep.)
Vegetation composition: typical species	Occurrence	Maintain typical species, in good condition, and demonstrating typical abundances and distribution	Maintain condition and extent of <i>Najas flexilis</i> (see conservation objective in this volume) and other typical 3130 species in Barnahallia Lough. Roden (2004) recorded, amongst other species, <i>Najas flexilis</i> , <i>Eriocaulon aquaticum</i> , <i>Chara virgata</i> , <i>Nitella confervacea</i> , <i>Nitella translucens</i> . Roden et al. (in prep.) described the typical species of lake habitat 3130 and those present in lakes in good condition. Lake habitat 3130 has a varied and species-rich flora with several rare species that can include <i>Baldellia ranunculoides</i> subsp. <i>repens</i> , <i>Hydrilla verticillata</i> , <i>Isoetes echinospora</i> , <i>Najas flexilis</i> , <i>Pilularia globulifera</i> , <i>Fissidens fontanus</i> , also two uncertain charophyte taxa: <i>Chara muscosa</i> ; <i>Nitella spanioclema</i> . See also NPWS (2013, 2019) and O Connor (2015)



Vegetation composition: characteristic zonation	Occurrence	Maintain characteristic deep-water vegetation	Barnahallia Lough slopes steeply to depths of 8m or more and <i>Najas flexilis</i> was found at 2-3m with scattered <i>Nitella</i> spp. and <i>Chara virgata</i> (Roden, 2004). These charophytes also occurred down to 4-5m. The characteristic zonation (three or more zones) is described in Roden et al. (in prep.). Shallow water has a <i>Lobelia-Littorella</i> zone (0-1.5m), then an <i>Isoetes lacustris</i> zone (0.5-3m), both also typical of oligotrophic lakes and lake habitat 3110. The characteristic deep water community is the most sensitive element and consists of some or all of <i>Callitriche hermaphroditica</i> , <i>Hydrilla verticillata</i> , <i>Najas flexilis</i> , <i>Potamogeton berchtoldii</i> , <i>P. perfoliatus</i> , <i>P. pusillus</i> , <i>Nitella confervacea</i> , <i>Nitella flexilis</i> , <i>Nitella translucens</i> . Full development is when a distinct deep water zone is present, with one or more of its typical species having >25% cover
Vegetation distribution: maximum (euphotic) depth	Metres	Maintain maximum depth of vegetation, subject to natural processes	Maximum depth of vegetation or euphotic depth was at least 5m in Barnahallia in 2004 (Roden, 2004). Euphotic depth ranged from 5.5 to <2m in lakes surveyed 2016-2018 and the target for maximum depth of vegetation colonisation (euphotic depth) in 3130 lakes was set as at least >3m (Roden et al., in prep.). Site-specific targets must be considered, however, as euphotic depths of >4m or >5m have been recorded in species-rich lakes in good condition and the target for Barnahallia is set at 5m or greater. Maximum depth is considered to have declined in many lakes, owing to increased water colour. Lakes within undisturbed peatland are expected to have clear water and large maximum vegetation depth
Hydrological regime: water level fluctuations	Metres	Maintain appropriate hydrological regime necessary to support the habitat	Roden et al. (in prep.) found that, in summer, the <i>Littorella</i> zone is typically submerged and said if more than half is exposed it is a matter of concern and water level should never be lower than the top of the <i>Isoetes</i> zone. Fluctuations in lake water level are typical in Ireland, but can be amplified by activities such as abstraction, drainage and overgrazing. Increased water level fluctuations can increase wave action, up-root vegetation, increase turbidity, alter the substratum and lead to release of nutrients from the sediment. Groundwater inputs are likely to be important for the characteristic deep-water zone and <i>Najas flexilis</i> (Gunn and Carvalho, 2020). The hydrological regime of the lake must be maintained so that the area, distribution and depth of the lake habitat and its constituent/characteristic vegetation zones and communities are not reduced
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	The shore of Barnahallia Lough consists of large boulders with mud at depth (Roden, 2004). Roden et al. (in prep.) found that the habitat is generally dominated by bedrock, sand and loose stones, silt mud or hard peat, and said that the appearance of large expanses of unconsolidated peat would indicate excessive sediment input. Groundwater inputs are likely to be important for the substratum of the characteristic deep-water zone and <i>Najas flexilis</i> (Gunn and Carvalho, 2020). Research is required to further characterise the chemical composition of the substratum

pH and Alkalinity	pH units, mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	The habitat is associated with intermediate alkalinity, largely between 20-80mg/l but lower values may occur on Old Red Sandstone (Roden et al., in prep.). Surveyed lakes had average alkalinity of 25mg/l (range 5.5-73mg/l) (Roden et al., in prep.). In line with targets for <i>Najas flexilis</i> , median pH values should be greater than 7 pH units. Groundwater may influence sediment and water chemistry and be important for <i>Najas flexilis</i> and other characteristic flora, contributing base-poor water to obligate carbon dioxide photosynthesisers in more calcareous lakes and more base-rich water to highly oligotrophic lakes. Acidification by organic acids released from degraded peatland and conifer plantations may impact on the habitat. See also The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019
Nutrients	mg/l P; mg/l N	Maintain the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	Roden et al. (in prep.) found that the best quality lakes surveyed had average total phosphorus of <0.015mg/l TP. Lakes in good condition with high-frequency nutrient data had an overall average of 0.011mg/l TP (lake averages ranged 0.008-0.015mg/l TP). While Roden et al. (in prep.) suggested a target of <0.015mg/l TP, a precautionary target for Good condition is set as ≤0.010mg/l or Water Framework Directive (WFD) High Status, however vegetation attributes determine the overall conservation condition. See also The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019). WFD High Status targets for total ammonia (annual average ≤0.04mg/l N and annual 95th percentile ≤0.09mg/l N) may also be appropriate
Water colour	mg/l PtCo	Maintain appropriate water colour to support the habitat	Barnahallia Lough had clear water in 2004 (Roden, 2004). The habitat is found in clear water, and water colour (dissolved light-absorbing compounds) is negatively correlated with maximum vegetation (euphotic) depth; lakes with euphotic depth >3m had colour <40mg/l PtCo, while those with euphotic depth >3.5m had <35mg/l PtCo (Roden et al., in prep.). Water colour directly controls light penetration and, therefore, euphotic depth and vegetation extent. Roden et al. (in prep.) set Good condition at <40mg/l PtCo, however this was considered to be an impacted state some distance from reference condition. The primary source of increased colour in Ireland is peatland disturbance, e.g. through turf-cutting, overgrazing, plantation forestry. Further work is necessary to determine water colour in intact peatland catchments and sustainable levels for the habitat, which may be <30 or even <20mg/l PtCo
Dissolved organic carbon (DOC)	mg/l	Maintain appropriate organic carbon levels to support the habitat	Dissolved organic carbon (DOC) in the water column is linked to water colour and acidification (organic acids). It can provide a substrate (food source) for heterotrophic organisms, which can impact directly (e.g. shading) and indirectly (e.g. nutrient release) on the characteristic lake communities. Damage and degradation of peatland, e.g. through afforestation or turf-cutting, leading to decomposition of peat is likely to be the predominant source of dissolved and particulate organic carbon in Ireland

Turbidity	Nephelometric turbidity units/ mg/l SS/ other appropriate unit	Maintain appropriate turbidity to support the habitat	Turbidity can significantly affect the quantity and quality of light reaching rooted and attached vegetation and can, therefore, impact on lake habitats. The settlement of higher loads of inorganic or organic material on lake vegetation communities may also have impacts on sensitive, delicate species. Turbidity can increase as a result of re-suspension of material within the lake, higher loads entering the lake, or eutrophication. Particulate loads from peatlands are the most likely sources of increased turbidity in lakes with the habitat. Turbidity measurement and interpretation is challenging. As a result, it is likely to be difficult to set habitat-specific targets for turbidity in lakes
Transparency	Metres	Maintain appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	Transparency relates to light penetration and, hence, to the depth of colonisation of vegetation. Roden et al. (in prep.) advised it is preferable to measure euphotic depth directly by observation, but noted that a decreasing trend in Secchi depth indicates declining water quality. Transparency can be affected by phytoplankton blooms, water colour and turbidity
Attached algal biomass	Algal cover	Maintain trace/ absent attached algal biomass (<5% cover)	Nutrient enrichment can favour epiphytic and epipellic algae that can out-compete the submerged vegetation. Roden et al. (in prep.) noted that occasional blooms of filamentous algae occur in 3130 lakes in the absence of excess nutrients, especially species of the orders Zygnematales or Oedogoniales, but that drifting masses of <i>Cladophora</i> species may indicate a decline in water quality. In general, the cover abundance of attached algae in lakes with 3130 should be trace/ absent (<5% cover)
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3130	On the western side, Barnahallia Lough merges gradually into reed bed, swamp, fen and blanket bog. It is surrounded by blanket bog, heath, acid grassland vegetation and exposed rock. Heterogeneous lake fringes with a range of natural and semi-natural habitats are preferable. Restoration or maintenance of open, species-rich fen, marsh and grassland can be particularly important. Fringing habitats along lakes intergrade with and support the structure and functions of the lake habitat. Equally, fringing wetland habitats are dependent on the lake, particularly its water levels, and support invertebrate and plant communities and species of high diversity and conservation concern. See also Mainstone et al. (2016)

## Conservation Objectives for : Barnahallia Lough SAC [002118]

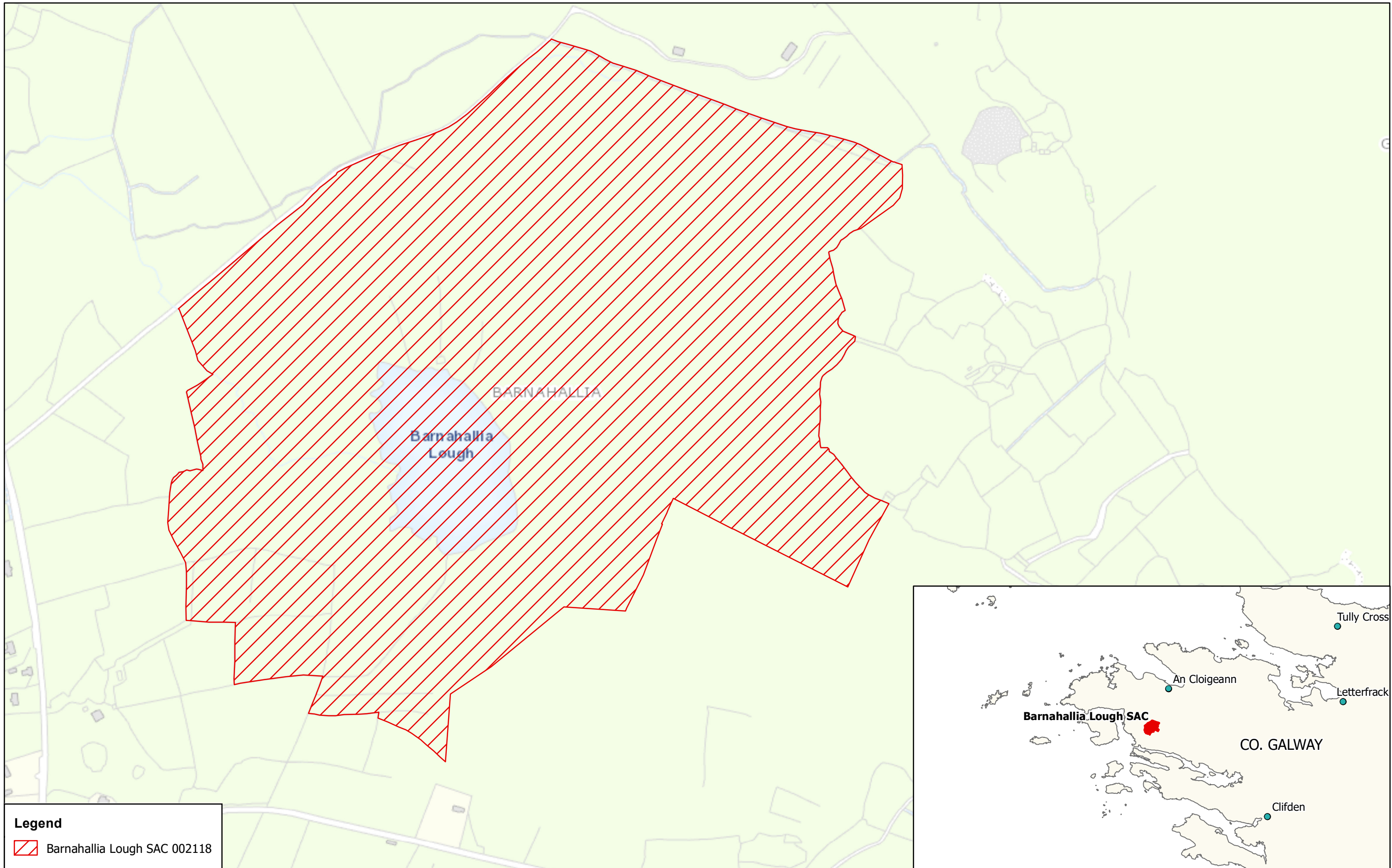
### 1833 Slender Naiad *Najas flexilis*

To maintain the favourable conservation condition of Slender Naiad in Barnahallia Lough SAC, which is defined by the following list of attributes and targets:


Attribute	Measure	Target	Notes
Population extent	Hectares; distribution	Maintain the spatial extent of slender naiad ( <i>Najas flexilis</i> ) within the lake, subject to natural processes	<i>Najas flexilis</i> was first recorded in Lough Barnahallia by M.J.P. Scannell in 1975. In July 2004, the western shore was examined and a substantial population (>500 plants) was recorded, growing at 2-3m amongst <i>Nitella</i> spp. and <i>Chara virgata</i> (Roden, 2004). Barnahallia was last surveyed in 2004 (Roden, 2004), and the current conservation condition of <i>Najas flexilis</i> is not known. There should be no sustained decline in the extent, overall size, cover abundance or density of the population in the lake. For further information on all attributes and targets, see Roden et al. (in prep.), O Connor (2013) and <i>Najas flexilis</i> conservation objective supporting documents for other SACs, for example SACs 001975 (NPWS, 2017), 001932 (NPWS, 2017) and 000365 (NPWS, 2017)
Population depth	Metres	Maintain the depth range of <i>Najas flexilis</i> within the lake, subject to natural processes	Roden (2004) recorded <i>Najas flexilis</i> at 2-3m, growing with <i>Nitella</i> spp. and <i>Chara virgata</i> , but noted it did not occur with these species at 4-5m. <i>Najas flexilis</i> is part of the characteristic deep-water community of lake habitat 3130 (Roden et al. 2020). <i>Najas flexilis</i> is frequently associated with the lower depths of macrophyte growth, where scattered plants gradually give way to bare mud or silt (Preston and Croft, 2001; Roden, 2002).
Population viability	Plant traits	Maintain plant fitness, subject to natural processes	Wingfield et al. (2004) used certain traits (leaf area/shoot length x reproductive number/shoot length) to assess <i>Najas flexilis</i> plant fitness and indicated a score of less than one would give rise to concern. Roden et al. (in prep.) suggested size measurements and photographs of the largest plants encountered may be non-destructive indicators of plant health
Population abundance	Square metres	Maintain the cover abundance of <i>Najas flexilis</i> , subject to natural processes	Roden (2004) recorded a 'substantial population' of >500 plants at the western end of Barnahallia, and a cover abundance of <25% in the relevé examined. Cover abundance is likely to vary within a lake, with depth, substratum and exposure. It may also vary inter-annually. However, there should be no sustained decline in the extent, overall size, cover abundance or density of the population in the lake
Species distribution	Occurrence	Maintain distribution, subject to natural processes	The full distribution of the species in Barnahallia Lough is not known. Roden (2004) examined the western shore. M.J.P. Scannell found a drift sample of <i>Najas flexilis</i> in 1975. For further information on the species and its distribution in Ireland, see O Connor (2013), <i>Najas flexilis</i> conservation objective supporting documents for other SACs and NPWS (2019)
Habitat extent	Hectares	Maintain habitat extent, subject to natural processes	Habitat extent relates to the area and quality of the available habitat for the species. Barnahallia Lough was last surveyed in 2004 (Roden, 2004), and the current conservation condition of the habitat (3130) for <i>Najas flexilis</i> is not known. See the conservation objective for lake habitat 3130 in this volume and Roden et al. (in prep.)


Vegetation distribution: maximum (euphotic) depth	Metres	Maintain maximum depth of vegetation, subject to natural processes	Maximum depth of vegetation or euphotic depth was at least 5m in Barnahallia in 2004 (Roden, 2004). Euphotic depth ranged from 5.5 to <2m and the most extensive populations were found in lakes with euphotic depths >2.5m, however several lakes with <i>Najas flexilis</i> had lower euphotic depths (Roden et al., in prep.). The target for maximum depth of vegetation colonisation (euphotic depth) was set as at least >3m (Roden et al., in prep.). Site-specific targets must be considered, however, as euphotic depths of >4m or >5m have been recorded in lakes with <i>Najas flexilis</i> in good condition and the target for Barnahallia is set at 5m or greater. See the conservation objective for habitat 3130 in this volume and Roden et al. (in prep.)
Hydrological regime: water level fluctuations	Metres	Maintain appropriate natural hydrological regime necessary to support the habitat for the species	The hydrological regime of the lakes must be maintained so that the area, distribution and depth of the <i>Najas flexilis</i> habitats are not reduced. Groundwater inputs are likely to be important for the characteristic deep-water zone and <i>Najas flexilis</i> (Gunn and Carvalho, 2020). See also the conservation objective for habitat 3130 in this volume and Roden et al. (in prep.)
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the population of the species	<i>Najas flexilis</i> grew on mud at 2-3m in Barnahallia (Roden, 2004). <i>Najas flexilis</i> is typically found on soft substrata of mud, silt or fine sand (Preston and Croft, 2001; Roden, 2002, 2004). The sediment chemistry of <i>Najas flexilis</i> lakes is described by Wingfield et al. (2004) and Gunn and Carvalho (2020). See also the conservation objective for habitat 3130 in this volume and Roden et al. (in prep.)
Nutrients	mg/l P; mg/l N	Maintain the concentration of nutrients in the water column at sufficiently low levels to support the population of the species	<i>Najas flexilis</i> is typically associated with high water quality. This is demonstrated by naturally low dissolved nutrients, clear water and low algal growth. The species' association with mixed geology, including some base-enrichment, is well-documented (Preston and Croft, 2001; Roden, 2004; Wingfield et al., 2004). While Roden et al. (in prep.) suggested a target of <0.015mg/l total phosphorus, a precautionary target for good condition is set as ≤0.010mg/l or Water Framework Directive (WFD) High Status, however population attributes determine the species' overall conservation condition. See also the conservation objective for lake habitat 3130 in this volume and Roden et al. (in prep.)
Water colour	mg/l PtCo	Maintain appropriate water colour to support the population of <i>Najas flexilis</i>	Barnahallia Lough had clear water in 2004 (Roden, 2004). The species is found in clear water (Roden et al., in prep.). Increased water colour (dissolved light-absorbing compounds) and turbidity decrease light penetration and can reduce the area of available <i>Najas flexilis</i> habitat, particularly at the lower euphotic depths. Water colour directly controls light penetration and, therefore, euphotic depth and vegetation extent. Roden et al. (in prep.) set good condition at <40mg/l PtCo, however this was considered to be an impacted state some distance from reference condition. Further work is necessary to determine sustainable water colour levels for the species which may be <30 or even <20mg/l PtCo. The primary source of increased colour in Ireland is peatland disturbance, e.g. through turf-cutting, overgrazing, plantation forestry. See also the conservation objective for lake habitat 3130 in this volume and Roden et al. (in prep.)

Dissolved organic carbon (DOC)	mg/l	Maintain appropriate organic carbon levels to support the population of <i>Najas flexilis</i>	Dissolved organic carbon (DOC) in the water column is linked to water colour and acidification (organic acids). It can provide a substrate (food source) for heterotrophic organisms, which can impact directly (e.g. shading) and indirectly (e.g. nutrient release) on the characteristic lake communities. Damage and degradation of peatland, e.g. through afforestation or turf-cutting, leading to decomposition of peat is likely to be the predominant source of dissolved and particulate organic carbon in Ireland
Acidification status	pH units; mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the population of <i>Najas flexilis</i> , subject to natural processes	The species is associated with intermediate alkalinity, largely between 20-80mg/l but also occurs in some lakes with lower values on Old Red Sandstone (Roden et al., in prep.). Acidification is considered a significant threat to <i>Najas flexilis</i> (Preston and Croft, 2001; Roden, 2004; Wingfield et al., 2004; Gunn and Carvalho, 2020). Wingfield et al. (2004) considered that <i>Najas flexilis</i> has rather specific environmental requirements and occupies a relatively narrow realised niche in Britain and Ireland. Groundwater may influence sediment and water chemistry and be important for <i>Najas flexilis</i> contributing base-poor water to this obligate carbon dioxide photosynthesiser in more calcareous lakes and more base-rich water to highly oligotrophic lakes. See also the conservation objective for lake habitat 3130 in this volume and Roden et al. (in prep.)
Associated species	Species composition and abundance	Maintain appropriate associated species and vegetation communities to support the population of <i>Najas flexilis</i>	<i>Najas flexilis</i> grew with <i>Chara virgata</i> , <i>Nitella confervacea</i> and <i>Isoetes lacustris</i> in the relevé taken in 2004. Other associated species recorded included <i>Nitella translucens</i> , <i>Elatine hexandra</i> , <i>Potamogeton perfoliatus</i> and <i>P. berchtoldii</i> (Roden, 2004). <i>Najas flexilis</i> is part of the characteristic and highly sensitive deep water community of lake habitat 3130 that consists of some or all of <i>Callitriche hermaphroditica</i> , <i>Hydrilla verticillata</i> , <i>Najas flexilis</i> , <i>Potamogeton berchtoldii</i> , <i>P. perfoliatus</i> , <i>P. pusillus</i> , <i>Nitella confervacea</i> , <i>Nitella flexilis</i> , <i>Nitella translucens</i> (Roden et al., in prep.). See also the conservation objective for lake habitat 3130 in this volume, Preston and Croft, 2001; Roden, 2004, 2007; Wingfield et al., 2004; O Connor, 2013; NPWS, 2019; Gunn and Carvalho, 2020
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the population of <i>Najas flexilis</i>	On the western side, Barnahallia Lough merges gradually into reed bed, swamp, fen and blanket bog. It is surrounded by blanket bog, heath, acid grassland vegetation and exposed rock. Roden (2004) said it appeared to be like a cliff-surrounded, low-lying corrie. Fringing habitats are an integral part of the structure and functioning of lake systems. Heterogeneous lake fringes with a range of natural and semi-natural habitats are preferable. Restoration or maintenance of open, species-rich fen, marsh and grassland can be particularly important. See also Mainstone et al. (2016)



**Legend**

 Barnahallia Lough SAC 002118



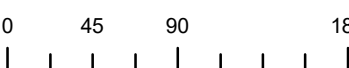
**An Roinn Tithíochta,  
Rialtais Áitiúil agus Oidhreachta**  
Department of Housing,  
Local Government and Heritage

**MAP 1:  
BARNAHALLIA LOUGH SAC  
CONSERVATION OBJECTIVES  
SAC DESIGNATION**

Map to be read in conjunction with the NPWS Conservation Objectives Document


**SITE CODE:  
SAC 002118; version 3.02.  
CO. GALWAY**

0 45 90 180 Metres

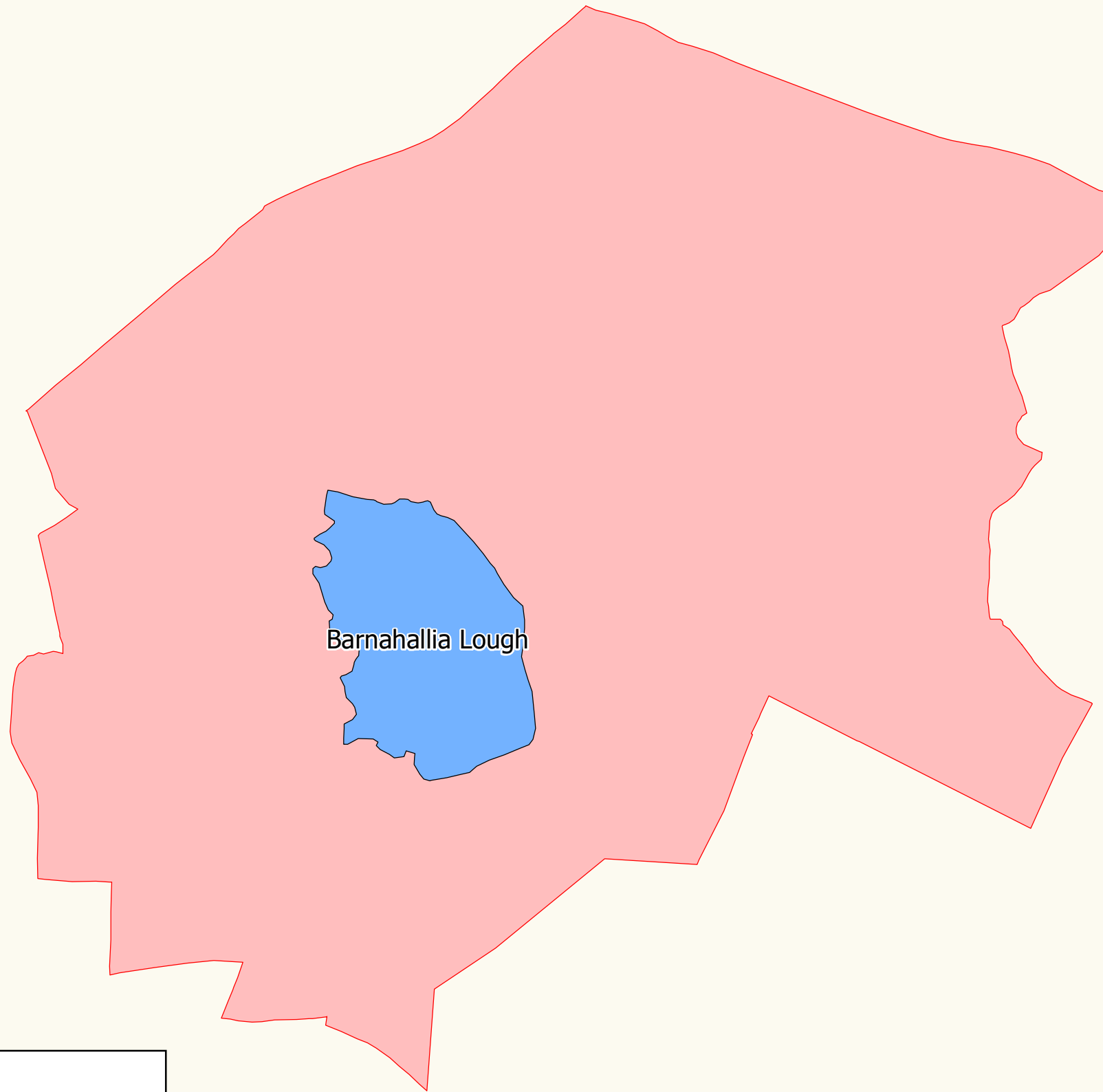


The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.  
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbheithnithé a déanamh ar theorainneacha na gceantar comharthaithé. Suirbhéarachta Ordonáis na hÉireann Ceadúnas Uimh OSI-NMA-014. © Suirbhéarachta Ordonáis na hÉireann Rialtas na hÉireann



**Date: March 2021**



Barnahallia Lough

**Legend**

- 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto- Nanojuncetea*
- Barnahallia Lough SAC 002118
- OSi Discovery Series County Boundary

