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Conservation Objectives Series

Lough Bane and Lough Glass SAC 002120

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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***

002120	Lough Bane and Lough Glass SAC
1092	White-clawed Crayfish *Austropotamobius pallipes*
3140	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	2013
Title :	A survey of the benthic macrophytes of three hard-water lakes: Lough Bunny, Lough Carra and Lough Owel
Author :	Roden, C.; Murphy, P.
Series :	Irish Wildlife Manuals, No. 70
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
Author :	NPWS
Series :	Conservation assessments
Year :	2015
Title :	Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting
Author :	O Connor, Á.
Series :	Unpublished document by NPWS
Year :	2019
Title :	The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments
Author :	NPWS
Series :	Conservation assessments
Year :	2020
Title :	Marl Lake (Habitat 3140) Survey and Assessment Methods Manual
Author :	Roden, C.; Murphy, P.; Ryan, J.; Doddy, P.
Series :	Irish Wildlife Manuals, No. 125
Year :	2020
Title :	Benthic vegetation in Irish marl lakes: monitoring habitat 3140 condition 2011 to 2018
Author :	Roden, C.; Murphy, P.; Ryan, J.
Series :	Irish Wildlife Manuals, No. 124
Year :	2020
Title :	Benthic vegetation in Irish marl lakes: monitoring habitat 3140 condition 2011 to 2018. Appendix III, Site Reports
Author :	Roden, C.; Murphy, P.; Ryan, J.
Series :	Irish Wildlife Manuals, No. 124
Year :	in prep.
Title :	Survey of the status of white-clawed crayfish, *Austropotamobius pallipes*, in designated SACs in 2017
Author :	Gammell, M.; McFarlane, A.; Brady, D.; O'Brien, J.; Mirimin, L.; Graham, C.; Lally, H.; Minto, C.; O'Connor, I.
Series :	Irish Wildlife Manuals

Other References

Year :	1982
Title :	Eutrophication of waters. Monitoring assessment and control
Author :	OECD
Series :	OECD, Paris

Year :	2006
Title :	A reference-based typology and ecological assessment system for Irish lakes. Preliminary investigations. Final report. Project 2000-FS-1-M1 Ecological assessment of lakes pilot study to establish monitoring methodologies EU (WFD)
Author :	Free, G.; Little, R.; Tierney, D.; Donnelly, K.; Coroni, R.
Series :	Environmental Protection Agency, Wexford
Year :	2008
Title :	The effect of excessive water abstraction on the vegetation and conservation status of Lough Bane, County Meath/Westmeath. Special Area of Conservation no 002120. Updated October 2008
Author :	Roden, C.
Series :	Report to Meath County Council
Year :	2009
Title :	The marl lakes of the British Isles
Author :	Pentecost, A.
Series :	Freshwater Reviews, 2(1): 167-197
Year :	2009
Title :	The effect of excessive water abstraction on the vegetation and conservation status of Lough Bane, county Meath/Westmeath. Results of monitoring programme. July 2008 -July 2009. 2nd Report (October 2009)
Author :	Roden, C.
Series :	Report to Meath County Council
Year :	2010
Title :	Water Quality in Ireland 2007-2009
Author :	McGarrigle, M.; Lucey, J.; Ó Cinnéide, M.
Series :	Environmental Protection Agency, Wexford
Year :	2010
Title :	The effect of excessive water abstraction on the vegetation and conservation status of Lough Bane, county Meath/Westmeath. 3rd Report (December 2010)
Author :	Roden, C.
Series :	Report to Meath County Council
Year :	2015
Title :	Water Quality in Ireland 2010-2012
Author :	Bradley, C.; Byrne, C.; Craig, M.; Free, G.; Gallagher, T.; Kennedy, B.; Little, R.; Lucey, J.; Mannix, A.; McCreesh, P.; McDermott, G.; McGarrigle, M.; Ní Longphuirt, S.; O'Boyle, S.; Plant, C.; Tierney, D.; Trodd, W.; Webster, P.; Wilkes, R.; Wynne, C.
Series :	Environmental Protection Agency, Wexford
Year :	2016
Title :	A narrative for conserving freshwater and wetland habitats in England
Author :	Mainstone, C.; Hall, R.; Diack, I.
Series :	Natural England Research Reports Number 064
Year :	2016
Title :	Lake ecological assessment metrics in Ireland: relationships with phosphorus and typology parameters and the implications for setting nutrient standards
Author :	Free, G.; Tierney, D.; Little, R.; Kelly, F.L.; Kennedy, B.; Plant, C.; Trodd, W.; Wynne, C.; Caroni R.; Byrne, C.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 116B: 191-204
Year :	2017
Title :	Water Quality in Ireland 2010-2015
Author :	Fanning, A.; Craig, M.; Webster, P.; Bradley, C.; Tierney, D.; Wilkes, R.; Mannix, A.; Treacy, P.; Kelly, F.; Geoghegan, R.; Kent, T.; Mageean, M.
Series :	Environmental Protection Agency, Wexford

Spatial data sources

Year :	2021
Title :	OSi Prime 2 water polygon file
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 :	3140 (map 2)

3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

To maintain the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. in Lough Bane and Lough Glass 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	Lough Bane and Lough Glass SAC contains a series of small hard-water lakes and ponds with habitat 3140, the principal being Lough Bane, which is of high ecological and conservation importance (Roden, 2010). Lough Bane was assessed as in good conservation condition in 2018 overall (Roden et al., 2020). It was in unfavourable condition in 2007-2009 owing to over-abstraction from 2004-06 which damaged shallow littoral communities, but recovered to good condition in 2010 (Roden, 2008, 2009, 2010). The area of the lakes was reduced by the Boyne Drainage Scheme 1969-1980. The surface area of the lake is the simplest measure of extent and should be stable or increasing. It may also be possible to estimate the area of the vegetation communities/zones that typify the habitat. Further information relating to all attributes is provided in Roden et al. (2020) and O Connor (2015). See also Pentecost (2009) and Roden et al. (2020) for an overview of marl lakes in Britain and Ireland
Habitat distribution	Occurrence	No decline, subject to natural processes	As noted above, habitat 3140 was monitored in Lough Bane in 2018 (Roden et al., 2020) and the impacts of over-abstraction were monitored in 2007, 2008, 2009 and 2010 (Roden, 2008, 2009, 2010). It is also a Water Framework Directive (WFD) monitoring lake. There are limited data for the other lakes and ponds in the SAC, including Lough Glass and Lough Glass North; however, habitat 3140 is likely to occur in all lakes and ponds in the SAC. See map 2
Vegetation composition: typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	See Roden et al. (2020) for records of characteristic marl lake species in Lough Bane, including 9 charophyte taxa, the rare *Chara denudata* amongst them. Mosses *Amblystegium riparium, Straminergon (Calliergon) stramineum, Calliergon giganteum, Brachythecium rivulare* and *Fontinalis antipyretica* occur at a deep underwater spring (Roden et al., 2020). *Chara hispida* was not found in 2007 following over-abstraction, but was found in 2009 and 2018 (Roden, 2008, 2009; Roden et al., 2020). For lists of 3140 typical species (cyanobacteria, algae, higher plants and water beetles), see the habitat 3140 Article 17 assessments (NPWS, 2013, 2019) and O Connor (2015). Roden et al. (2020) list species present in marl lakes in good condition, as well as other widespread and local/rare species

Vegetation composition: characteristic zonation	Occurrence	Maintain characteristic charophyte and crust zones	Lough Bane has all 5 characteristic vegetation zones; the crust zone is small owing to the paucity of outcropping rock (Roden et al., 2020). The steep slopes lead to very compressed vegetation zones: the euphotic zone is <30m wide over most of the lake (Roden, 2008). In 2007, over-abstraction impacts were detected to the upper *Chara rudis* zone (Roden, 2008). The characteristic zonation of 3140 was described in Roden and Murphy (2013) and updated by Roden et al. (2020). Marl lakes in good condition have 4 or more characteristic vegetation zones present, typically including a cyanophyte crust zone with occasional *C. virgata* var. *annulata*, a *C. curta* zone, a *C. rudis* zone, a *C. virgata* zone and, in some lakes, a *C. denudata* or *Nitella flexilis* zone. Roden et al. (2020) also provide methods for assessing the condition of the cyanophyte crust (3 metrics) and a novel indicator (C&K score) of good structure and function
Vegetation distribution: maximum depth	Metres	Maintain maximum depth of vegetation (euphotic depth), subject to natural processes	Maximum depth of vegetation was 8.8m in Lough Bane in 2018 and 9m in 2007 (Roden et al., 2020; Roden, 2008). Despite this high euphotic depth, the lake bed shelves steeply and most of the lake is too deep to support benthic macrophytes (Roden, 2008). It is notable that over-abstraction in 2004-06 did not impact on the euphotic depth/deep water communities, but significant impacts were found from shoreline to the base of the *Chara curta* zone and probably into the upper part of the *Chara rudis* zone (Roden, 2008, 2009, 2010). The target for maximum depth of vegetation colonisation (euphotic depth) in marl lakes is >7m (Roden et al., 2020). Euphotic depth is considered to be a key measure of the structure and functions of marl lake vegetation and has been found to exceed 10m in some Irish marl lakes (Roden et al., 2020)
Hydrological regime: water level fluctuations	Metres	Maintain appropriate hydrological regime necessary to support the habitat	Water level is monitored at Lough Bane for the Kells/Oldcastle Water Supply Scheme (see Environmental Protection Agency (EPA) HydroNet). As noted above, over-abstraction in 2006-08 resulted in water levels below the minimum permitted for extended periods, the emersion of permanently submerged vegetation and the habitat declining to unfavourable condition in 2007, 2008 and 2009 (Roden, 2008, 2009). Water level was assessed as good in 2010 and 2018 (Roden, 2010; Roden et al., 2020). Lough Bane is also within the Boyne Drainage Scheme. In summer, more than 90% of the crust zone should be covered and water level should never be lower than the top of the *Chara curta* zone; in winter, all zones should be submerged (Roden et al., 2020). Groundwater normally exerts a strong influence on the hydrology of marl lakes. 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
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	Roden et al. (2020) recorded marl and rock at Lough Bane. In 2007, the abundance of *Phragmites australis* in shallow water, *Ophrydium versatile* in the cyanophyte crust zone and filamentous algae in the *Chara curta* zone may have indicated a release of nutrients from substratum exposed to air by over-abstraction (Roden, 2008). In general, marl lakes are dominated by limestone bedrock, calcareous silt and sand, and loose stones (Roden et al., 2020). Deposited peat may indicate excessive sediment inputs and sediment can accumulate phosphorus and release it into the water column (Roden et al., 2020). Further research into acceptable sediment phosphorus concentrations and other aspects of substratum quality in marl lakes would be beneficial

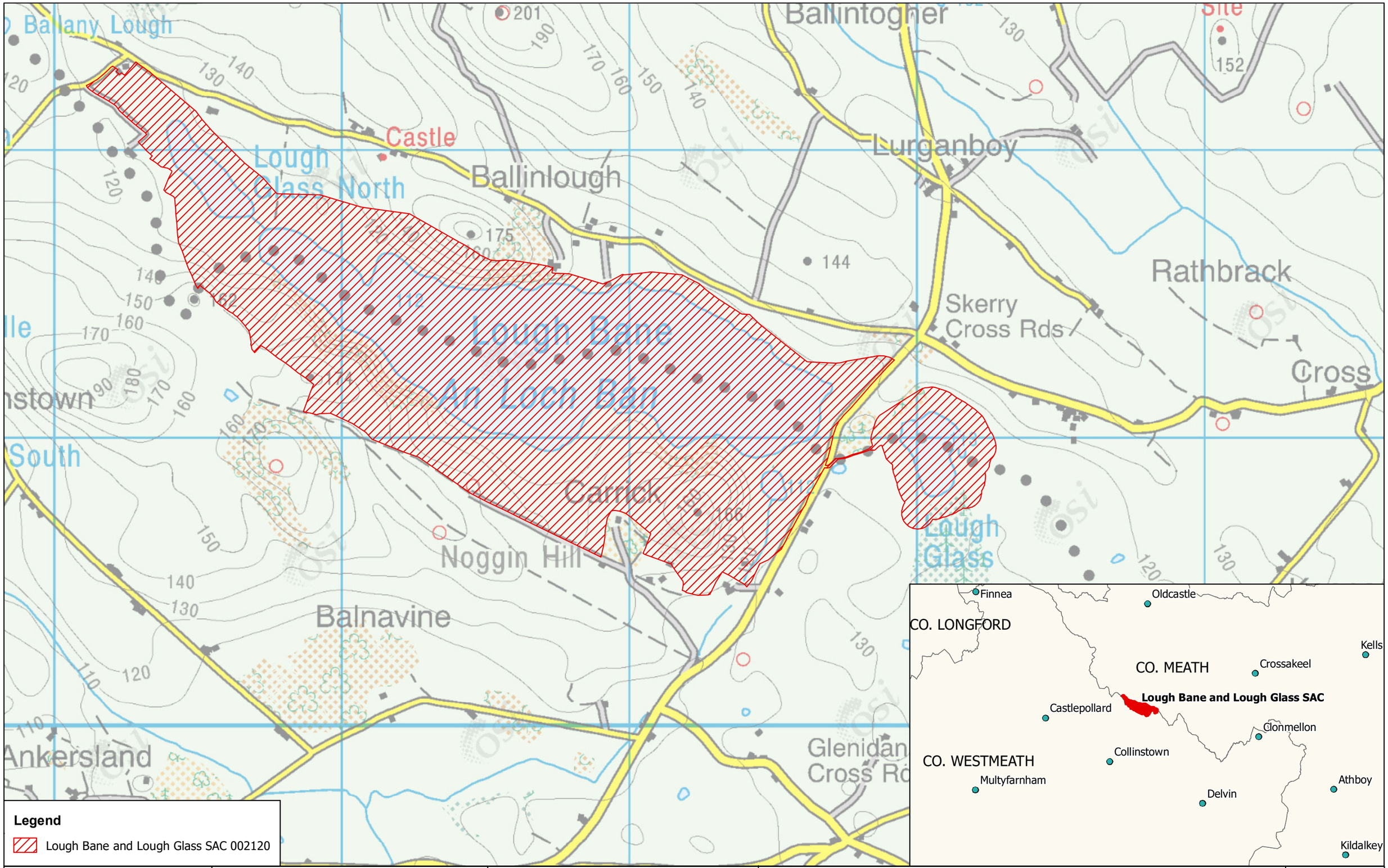
pH and Alkalinity	pH units, mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	Roden et al. (2020) reported alkalinity of 131mg/l and pH of 8.1 in Lough Bane. The lower alkalinity boundary may lie between 80 and 100mg/l; however, alkalinity is far higher in most Irish marl lakes, exceeding 200mg/l in some cases (Roden et al., 2020). Acidification is not considered a threat to habitat 3140; however, eutrophication can lead to at least temporary increases in pH to toxic levels (>9/9.5 pH units). Maximum pH should be <9.0 pH units, in line with the surface water standards (The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019). Further study of the sediment pH, alkalinity and cation concentration may assist in understanding of nutrient cycling
Nutrients	mg/l P; mg/l N	Maintain the concentration of nutrients in the water column at sufficiently low levels to support the habitat and its typical species	Roden et al. (2020) reported average total phosphorus (TP) of 0.006mg/l in Lough Bane from 2008-15 EPA data. EPA reported High nutrient status in Bane 2010-15, but Good in 2007-09 owing to ammonia. Roden (2009) found higher nitrogen levels in Bane in 2008-09 than in 1992-93. Roden et al. (2020) found that most marl lakes in good condition have TP ≤0.01mg/l. While vegetation attributes determine the habitat's conservation condition and some good condition marl lakes have higher TP concentrations, ≤0.01mg/l is the target for good condition proposed by Roden et al. (2020). The ≤0.01mg/l TP target is equivalent to oligotrophic (OECD, 1982) and WFD High Status (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. See also Free et al. (2016), McGarrigle et al. (2010), Bradley et al. (2015), Fanning et al. (2017)
Water colour	mg/l PtCo	Maintain appropriate water colour to support the habitat	Roden et al. (2020) reported colour of 4.2mg/l PtCo in Lough Bane in 2018. Colour was higher in 2008-09, ranging from 7.8-35.2mg/l PtCo (Roden, 2009). Free et al. (2006) reported lower colour of 1mg/l PtCo in Bane in 2001-02. Roden et al. (2020) found that water colour (dissolved light-absorbing compounds) is negatively correlated with euphotic depth, charophyte species richness and cover, and positively correlated with vascular plant cover in marl lakes. Roden et al. (2020) set good condition at <15mg/l PtCo; however, it should be noted that the most important Irish marl lakes have very clear waters with colour of <5mg/l PtCo. Roden et al. (2020) also set a TP×Colour Index with a target of <0.1 for good; Lough Bane was 0.025 in 2018. Increased colour decreases light penetration and reduces the area of macrophyte habitat, particularly at the lower euphotic depths. The primary source of increased colour in Ireland is peatland disturbance
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. 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, 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	Lough Bane is a very clear marl lake (Roden, 2008, 2009, 2010). 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. 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	Secchi depth was not measured in 2018, but Lough Bane had Secchi depth of 7.8m in 2001-02 (Free et al., 2006) and 4.8m in 2007-08 (Roden, 2008). Transparency relates to light penetration and, hence, to the depth of colonisation of vegetation. Roden et al. (2020) 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. Secchi depth in marl lakes in Good condition is generally >6m. The OECD fixed boundary system set transparency targets for oligotrophic lakes of ≥6m annual mean Secchi disk depth and ≥3m annual minimum Secchi disk depth
Attached algal biomass	Algal cover	Maintain trace/absent attached algal biomass (<5% cover)	No filamentous algae were noted in Lough Bane in 2018, 2008, 2009 or 2010; however, abundant filamentous algae occurred in the *Chara curta* zone in 2007, possibly indicative of nutrient release from substratum that dried out in 2004-06 (Roden, 2008, 2009, 2010; Roden et al., 2020). The colonial flagellate *Ophrydium versatile* was abundant in the cyanophyte crust zone in 2007, as was cladoceran zooplankton, but neither have been recorded since. Nutrient enrichment can favour epiphytic and epipelic algae that can out-compete the submerged vegetation. Roden et al. (2020) noted that occasional blooms of filamentous algae occur in marl lakes in the absence of excess nutrients, especially species of the orders Zygnematales or Oedogoniales. Drifting masses of *Cladophora* species may indicate a decline in water quality. In general, the cover abundance of attached algae in marl lakes (3140) 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 3140	Much of the shoreline of Lough Bane has a *Phragmites australis* fringe, particularly at the east and west ends. Swamp and fen vegetation also occur along the east and west shores, and mixed woodland on south and north shores. There is also some dry calcareous grassland. The recorded impacts of over-abstraction in 2007-09 included terrestrial plants e.g. *Mentha aquatica* and *Carex* spp. growing submerged beside aquatic species e.g. *Chara contraria*; by 2010, these had retreated to dry land (Roden, 2010). The fringing habitats along lake shorelines intergrade with and support the structure and functions of the lake habitat. Equally, fringing habitats are dependent on the lake, particularly its water levels, and support wetland communities and species of conservation concern. Many of the fringing wetland habitats support higher invertebrate and plant species richness than the lake habitats themselves. See also Mainstone et al. (2016)

1092 White-clawed Crayfish *Austropotamobius pallipes*

To restore the favourable conservation condition of White-clawed Crayfish (*Austropotamobius pallipes*) in Lough Bane and Lough Glass SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Number of occupied 1km squares	Restore presence in lake	White-clawed crayfish (*Austropotamobius pallipes*) was known from Lough Bane but the species disappeared from it in the 1980s. None were found in the lake by Gammell et al. (in prep.). Further work is required before a more specific target can be set
Negative indicator species	Occurrence	No non-indigenous crayfish species	Non-indigenous crayfish species (NICS) are identified as a major direct threat to the white-clawed crayfish (*Austropotamobius pallipes*) and as a disease vector, in particular crayfish plague (*Aphanomyces astaci*), which is fatal to white-clawed crayfish. The possession, import and intentional release of five species of invasive alien crayfish is banned by Statutory Instrument No. 354/2018. Should these become established in this SAC, then reintroduction of the species will probably be impossible
Disease	Occurrence	No instances of disease	Crayfish plague, caused by the water-borne mould *Aphanomyces astaci*, is identified as major threat to the species in Ireland. Instances of crayfish plague have occurred in Ireland since 2015 causing local extinctions. The extinction of white-clawed crayfish from Lough Bane is considered to have been caused by plague
Water quality	Water chemistry measures	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	White-clawed crayfish is not considered very sensitive of water quality but the species is intolerant of low pH and poorest water quality and lack of calcareous influence. There should be no decline in the water quality as defined by the targets for Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. (Annex I habitat 3140) as these are more stringent than white-clawed crayfish requires. See the conservation objective for habitat 3140 in this volume for further details
Habitat quality: heterogeneity	Occurrence of positive habitat features	No decline from the baseline	White-clawed crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus such as leaf litter. These conditions and habitat features must be available on the whole length of occupied habitat. Gammell et al. (in prep.) scored the habitat heterogeneity for Lough Bane and following this methodology, a baseline score of 0.57 is set



Legend

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MAP 1:
LOUGH BANE AND LOUGH GLASS SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

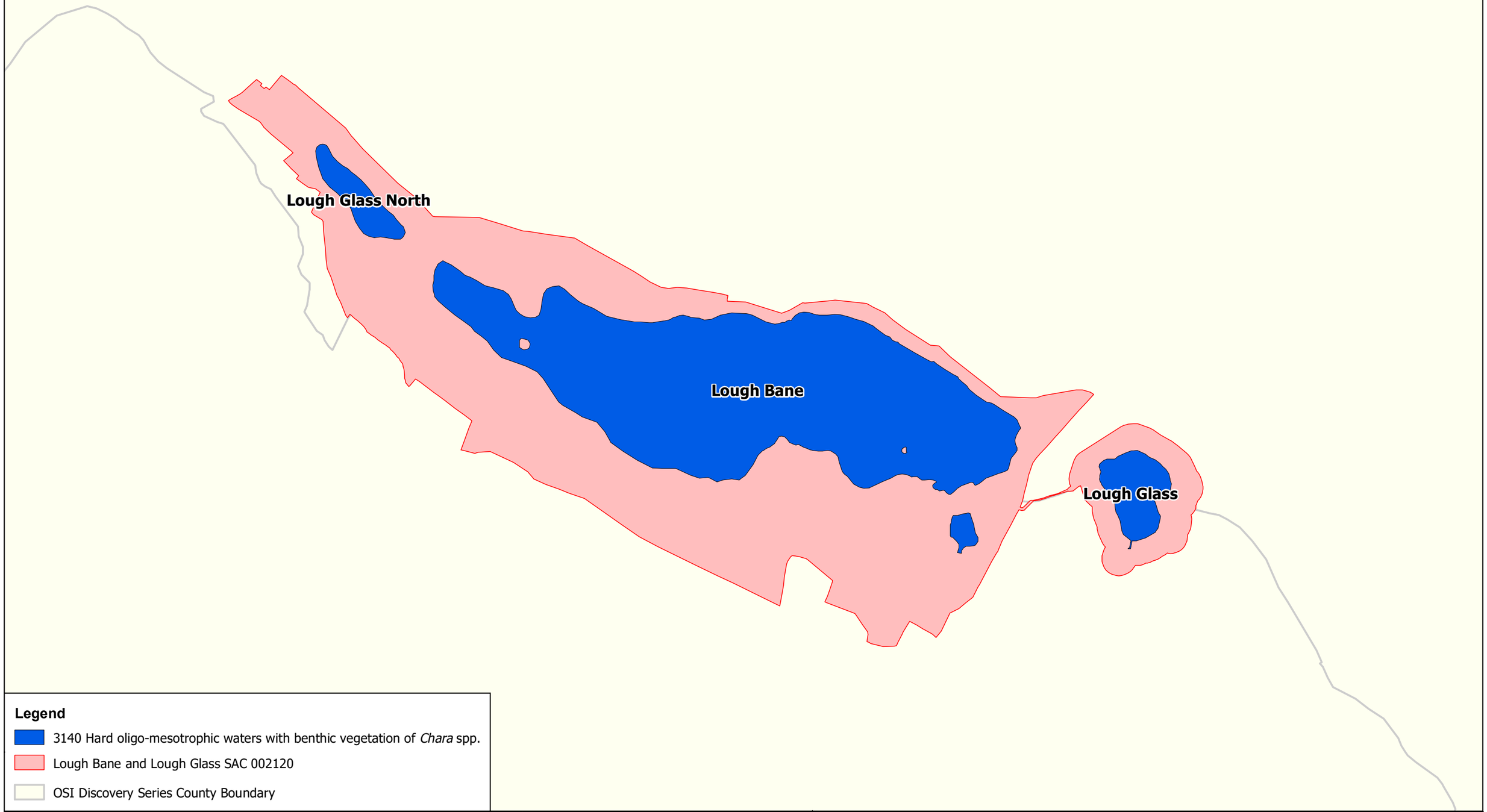
Map to be read in conjunction with the NPWS Conservation Objectives Document

SITE CODE:
SAC 002120; version 3.
CO. MEATH / WESTMEATH

0 0.125 0.25 0.5 Kilometres

N

Date: October 2021



Legend

- 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.
- Lough Bane and Lough Glass SAC 002120
- OSI Discovery Series County Boundary

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MAP 2:
LOUGH BANE AND LOUGH GLASS SAC
CONSERVATION OBJECTIVES
INDICATIVE LAKE HABITATS

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

SITE CODE:
SAC 002120; version 3.
CO. MEATH / WESTMEATH

0 0.125 0.25 0.5 Kilometres

N

Date: October 2021