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DOE NIEA Standing Freshwater Monitoring of Special Areas of Conservation (SAC) and Areas Special Scientific Interest (ASSI) (Second Round) P_12324

ECRC Research Report Number 168

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Executive Summary

This report was commissioned by the Northern Ireland Environment Agency (NIEA) and provides an assessment of the conservation status of selected water bodies within Northern Ireland. A total of 72 water bodies were surveyed, all of which were surveyed as part of the Northern Ireland Lakes Survey (NILS) (1988-1992). Nineteen of the 72 sites were surveyed in 2006 by ENSIS Ltd. as part of a similar round of assessments throughout Northern Ireland (Goldsmith *et al*., 2008).

The original aim of this project was to survey 145 sites split between two macrophyte survey years, with the first year focusing on a dense cluster of lakes within the southwest of the country and the second year focusing on the rest of the country. Cuts to departmental budgets in Northern Ireland meant that the project was cut short and the full programme of macrophyte surveys throughout the country was not completed. As a result there is a bias in this report towards full assessment of sites mostly within the southwest of Northern Ireland.

Site condition is assessed using Common Standards Monitoring (CSM) methods, where specific habitat feature attributes are assessed against targets corresponding to 'favourable' condition. The CSM methods have been updated recently (JNCC 2015) and supersede the guidance from 2005 (JNCC 2005). The guidance remains broadly similar with limited change in survey methodology but guidance relating to interpretation has altered where recent advances in understanding have occurred. The changes in guidance mostly affect the assessment of marl and eutrophic type lakes.

To make these assessments ENSIS biologists undertook macrophyte surveys during the summer of 2014 and 2015 as well as the collection of quarterly water samples for chemical analysis in 20014/15. Data from previous surveys conducted during the Northern Ireland Lake Survey and the previous round of CSM assessments (Goldsmith et al., 2008) were also used where available to provide a longer-term perspective and where possible used to suggest possible biological and chemical trends.

The results of the site condition assessments are discussed in terms of general categories of impact (e.g. eutrophication, disturbance and invasive species). Sites are classified as "favourable", "favourable (at risk)" and "unfavourable". Where sites are deemed to be "at risk" or are in unfavourable condition, recommendations for further investigation and / or management have been made. 53 sites are being assessed for the first time using CSM assessment and there is no comparable data available to determine directional changes in condition for these sites. The current assessments form a standard baseline for site condition from which future assessments can be made. The remaining 19 sites were first assessed in 2006 using CSM guidance. For these sites the assessment will make reference to the previous assessment and comment on directional changes in the condition of these. However, due to the updating of the CSM guidance a direct comparison with the previous report was not always possible.

From a total of 72 water bodies assessed within this project 54 (75%) were classed as being in unfavourable condition and 19 (25%) were classed as being in

favourable condition. Of these 19 favourable sites however, 14 (19%) were considered to be at risk of future deterioration. Within the different habitat types, the "natural dystrophic lakes and ponds" were all considered to be in favourable, at risk condition. 13 out of 35 "oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*" were classified as favourable, but 10 of these were "at risk" with possible nutrient enrichment and species decline identified as the primary risk and failure to comply with CSM guidelines. The remaining 22 "oligotrophic to mesotrophic standing waters" were classed as unfavourable. Pressures such as forestry, nutrient enrichment and invasive species were all identified as probable causes of non-compliance. Only three of the 23 "natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation" were favourable, all of which were "at risk", with eutrophication and non-native, invasive species being the primary reason for non compliance. The most concerning group were the twelve "hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp." all of which were classed as unfavourable. Two of these sites (Kilroosky (1005) and Annachullion (997)) were previously classed as favourable in the 2006 assessments and two more (Burdautien (202) and Drumcrittin (986)) showed declines in *Chara* spp. abundance and diversity when compared to the 2006 assessment. Eutrophication was identified as the primary reason for non-complience and continued decline of these sites.

As a result of the water chemistry and macrophyte surveys the habitat type two of the 72 sites were reclassified. Lough Any (224) was previously classed as an "oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*" type lake, but was considered to be more closely aligned to a "natural dystrophic lakes and ponds". Prior to this report Legalough (1667) was also classified as an "oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*" type lake but was considered to be a "hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp." It is recommended that for all future assessments these lakes are classified using this updated habitat type.

Although some lakes surveyed in this assessment were considered to be excellent examples of their lake type showing characteristic flora and water chemistry the majority of the lakes are in an unfavourable condition with some common pressures impacting many of the sites. High nutrient inputs, invasive species, poor floristic composition, land management and shore modifications were all sited as causes for non-compliance. It is recommended that nutrient sources are investigated and where possible management action taken to reduce inputs to surface waters. Eutrophication is likely to come from both point and diffuse sources, and its effects may be exacerbated by local management practices such as grazing and fish stocking. Non-native invasive species should be controlled by promoting good biosecurity by all lake users and the value of many of the lakes, especially the ASSI's should be well publicised and management of these lakes done so within the framework of the legislative protection.

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Chara rudis – Photo: C. Ferguson-Smyth (Approx. x40 – composite image)

1. Introduction

1.1. Project Background

Northern Ireland is particularly rich in wetland habitats, which include rivers, lakes (loughs) and ponds. The standing open waters are one of Northern Ireland's most extensive natural habitats with more than 1,600 identified from within the region ranging in size from small ponds to Lough Neagh, the largest area of freshwater within the British Isles. In addition to the open water, these sites are often integral within a varied mosaic of other important natural environments including swamps, wet grassland, reed fen, carr woodland and peatland bogs.

These wetland habitats are vulnerable to changes in water conditions, with nutrient enrichment being one of the most serious threats. Nutrient enrichment can alter the ecological balance of a water body causing a reduction in diversity and overall reduction in habitat quality.

In order to better understand and protect these habitats, there is a requirement under the EC Habitats Directive (1992) to report on the status of standing freshwater lake types (features) of community interest as set out in Annex 1 of the Directive. Importantly, this provision is not restricted only to designated sites, (Natura 2000 and ASSI sites) and so data needs to be collected from both within and outside the designated site network to enable a full assessment of conservation status of the habitat(s) in the member state. The Client also has obligations under the Water Framework Directive to monitor the ecological status and ecological potential of surface water. In order to measure achievement against these commitments, Northern Ireland Environment Agency (NIEA) began a programme of Common Standards Monitoring in 2002 and Water Framework monitoring in 2007.

So as to standardise the assessment of these standing waters across the UK, the Conservation Agencies devised a Common Standards Monitoring (CSM) protocol, first published in its entirety in 2005 (JNCC, 2005). This has since been used to assess the condition of the Annex 1 habitat features in Northern Ireland (e.g. Goldsmith *el al* 2008). This original document sets out the standardised field methods for data collection and details the targets to be used for site condition assessments of water bodies in a series of favourable condition tables (FCT). The intention of the protocol was to gather the maximum amount of information about the ecology of each water body in the most efficient way possible.

The CSM guidance was updated during the period of this project (JNCC 2015) and while the collection of field data was unaffected, interpretation of the data with respect to species composition and some water quality parameters have been revised and these have been incorporated into the results.

The updated CSM guidance has been used in this project to assess the condition of standing water features against the four Annex 1 habitats that occur naturally or semi-naturally in Northern Ireland:

- H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and / or of the *Isoëto-Nanojuncetea*
- H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

- H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation
- H3160: Natural dystrophic lakes and ponds

Full descriptions of these habitat types are given in McLeod *et al*. (2005).

During 2006-2007, ENSIS Ltd., under contract to NIEA (formally EHS) collected a large limnological dataset (physical, chemical and biological data) using the CSM protocol (JNCC 2005). These data were used to assess 111 water bodies across Northern Ireland encompassing 8 SACs (81 loughs) and a further 15 ASSIs (30 loughs). A proportion of these sites have been re-assessed within this project thereby enabling comparative assessments. Inevitably, changes to the CSM guidance have complicated comparisons and these changes are highlighted within the assessments and discussed in terms of overall condition.

1.2. Project Objectives

The purpose of this project is to carry out a program of condition assessment monitoring of a stratified selection of the different Habitats Directive Annex 1 lake types or features occurring in Northern Ireland, including a subset of lakes within the designated site network.

The output of this research i.e. condition assessment reports of sites and associated data will be used to:
(a) target habitat management to either maintain a feature in favourable condition or return lake features to favourable condition and
(b) facilitate reporting on the overall condition of the various lake types (features) occurring in Northern Ireland.

1.3. Addendum - Changes to Specification

The original scope of the project was to sample and assess 145 standing water sites within Northern Ireland during 2014 and 2015. As a result of changes to the funding allocation made by the Northern Ireland Executive, NIEA were unable to commit full funds to year 2 of the project and therefore only 72 of the original 145 sites were surveyed for macrophytes. Due to the way the environmental monitoring was structured however, chemical samples were taken from all 145 sites, although the year 2 subset had only 3 quarterly samples collected.

2. Methods

2.1. Site Selection

The selection of standing waters sites was made in two ways. NIEA provided a list of 45 standing waters from within the Natura 2000 and ASSI networks (Table 2). Selection of these 'designated' loughs was based on the results of the previous monitoring assessment and a risk-based approach to subsequent monitoring.

Selection of the additional 100 loughs was the responsibility of Ensis with subsequent agreement from NIEA. The intention was that the 100 additional sites should be a representative sample of the EU Habitats Directive Annex 1 standing water types occurring within Northern Ireland. The original intention being that all 100 sites would be drawn at random from outside designated areas in order to provide a full appreciation of the conservation status of each habitat feature type throughout Northern Ireland. In practice however, it was considered to be of more value to concentrate on the lough sites surveyed for macrophytes during the Northern Ireland Lake Survey (NILS) during 1988-1991 (Wolfe-Murphy *et al.* 1992). A subset of 251 of these lough sites was therefore provided by NIEA (Table 372, Appendix 1) from which to randomly select 100 representative lakes for survey. This did not include Lough Neagh the five large loughs (Upper and Lower Lough Erne, Lough Melvin, Upper and Lower Lough Macnean) which were excluded from selection due to them being monitored separately under WFD requirements.

In order to ensure the final list of sites was representative of the regions loughs, a random, stratified selection method was used. After amalgamating site details into one spreadsheet, sites were divided first into two categories dependent on their altitude (split at 250 m amsl) and then sub-divided by lough area into 3 broad categories:

i. 0 -1.0 ha
ii. 1.1 – 10 ha
iii. 11 – 100 ha

The percentage of sites which fell into each sub-category was calculated and used to calculate the number of sites out of 100 lake per category. This was also extended to select an additional 50 sites to ensure replacements sites were available if required (Table 1).

Table 1 Stratified site selection matrix (n = 251 sites)

	Lowland (<250 m)				Upland (>250 m)			
			Sites to be selected from:				Sites to be selected from:	
Lough Area	**Sites**	**% of Total**	**100**	**150**	**Sites**	**% of Total**	**100**	**150**
0-1 ha	20	8	8	12	9	4	4	5
1.1-10 ha	129	51	51	77	32	13	13	19
11-100 ha	58	23	23	35	3	1	1	2

Within each sub-category, every site was then assigned a random number using the MS Excel function =rand(). This was then used to randomly select the proportionate number of lakes per sub-category using the following formula:

=INDEX($B$2:$B$15,RANK(H2,$H$2:$H$15))

Initially ordered by sequential NI lake number, this process was used to re-order (by random number) and select a proportionate number of sites from each sub-category to achieve 100 sites. A further 50 sites were also included to provide a list from which replacement sites could be taken as required.

While every effort was made to ensure the selected sites were suitable for survey, five of the sites from the selection process required replacements due to the following reasons:

- Clabby Lough 827 (H414493) was found to be very shallow with much of the open water encroached by terrestrial vegetation. Replaced with Un-named Lough 1595 (J006169) near Shean, C. Armagh.
- Lough Tullynasiddagh 1666 (G985653) has only a very small percentage of its total area within Northern Ireland and was therefore replaced by Eskragh lough 1082 (H772618)
- Killea Reservior 89 (C387163) unable to access on first attempt due to the surrounding fence. Site replaced with Straghans Lough 1147 (H823307)
- Loughnanskan 45 (D110523). Permission to access refused. Replaced by Lee Lough 247 (H255761).
- Lough Cooy 774 (H233481). Permission to access refused. Replaced by Lough Yoan 763 (H253423).

The final selection of designated sites are listed in Table 2 and randomly selected sites detailed in Table 3 and shown in Figure 1.

Table 2 Designated sites selected for survey (n=45)

Lough Name	NI Lake No	Grid Ref	Type	Altitude (m amsl)	Area (ha)
Lough na Cranagh	28	D179427	Isoetid	125	8.25
Loughisland	186	D253198	Isoetid	345	1.25
Black Lough	187	D255201	Isoetid	355	0.25
Loughnabrick	191	D258199	Isoetid	350	1.25
Loughfine	192	D263203	Isoetid	345	1.50
Burdautien Lough	202	H494283	Marl	55	1.5
Loughnaweelagh	231	H052832	Isoetid	365	2.75
Oak Lough	308	H498841	Dystrophic	165	1.5
Black Lough	313	H499845	Dystrophic	165	0.25
Loughnafreaghoge	318	H577794	Dystrophic	180	1.5
Black Lough	324	H577793	Dystrophic	180	0.5
Lough Macrory	327	H576793	Isoetid	170	21.00

Lough Name	NI Lake No	Grid Ref	Type	Altitude (m amsl)	Area (ha)
Loughnafeebane	344	H580791	Dystrophic	185	0.75
Lough Achork	630	H042555	Isoetid	210	3.00
Lough Vearty	638	G994658	Isoetid	110	47.00
Mallybreen Lough	644	H011661	Isoetid	140	1.25
Lough Scolban	647	G995605	Isoetid	50	64.00
Tullylough Beg	653	H028637	Isoetid	105	0.25
Lough Nafeola	654	H032645	Isoetid	125	1.00
Lough Aleater	682	G975495	Isoetid	105	5.25
Lough Anierin	689	G995472	Isoetid	105	5.75
Lough Navar	690	H028547	Isoetid	215	26.50
Lough Naman	691	H031522	Isoetid	205	5.25
Derrynacarbit Lough	694	H005506	Isoetid	145	3.00
Lough Doo	697	H038565	Isoetid	205	3.00
Tullywannia Lough	699	H044508	Isoetid	195	1.75
Lough Formal	701	H047474	Isoetid	240	8.00
Doagh Lough	722	H078521	Eutrophic	140	4
Lough Atona	781	H110292	Dystrophic	475	2.5
Round Lough	835	H443485	Eutrophic	100	3
Glenbower Lough	851	H549446	Dystrophic	325	1.25
Lough Navarad	875	H558447	Dystrophic	320	5
Mill Lough	885	H245385	Eutrophic	50	33
Lough Doo	912	H346301	Eutrophic	45	7
Knockballymore B	950	H479269	Eutrophic	45	0.5
Drumacrittin Lough	986	H549328	Marl	65	4
Annachullion Lough	997	H519303	Marl	65	1
Kilroosky Lough	1005	H495274	Marl	55	3.75
Lough Sarah	1027	H423198	Eutrophic	45	3
Tullybrick Lough	1135	H751398	Marl	35	2
Lough Cowey	1347	J595543	Eutrophic	10	26
Cam Lough	1549	J035245	Isoetid	100	68.00
Blue Lough	1574	J327253	Isoetid	340	2.00
Castlewellan lake	1581	J325368	Isoetid	120	34.00
Greenan Lough	1605	J119233	Isoetid	35	11.00

Figure 1 Map of sampling sites showing size classes

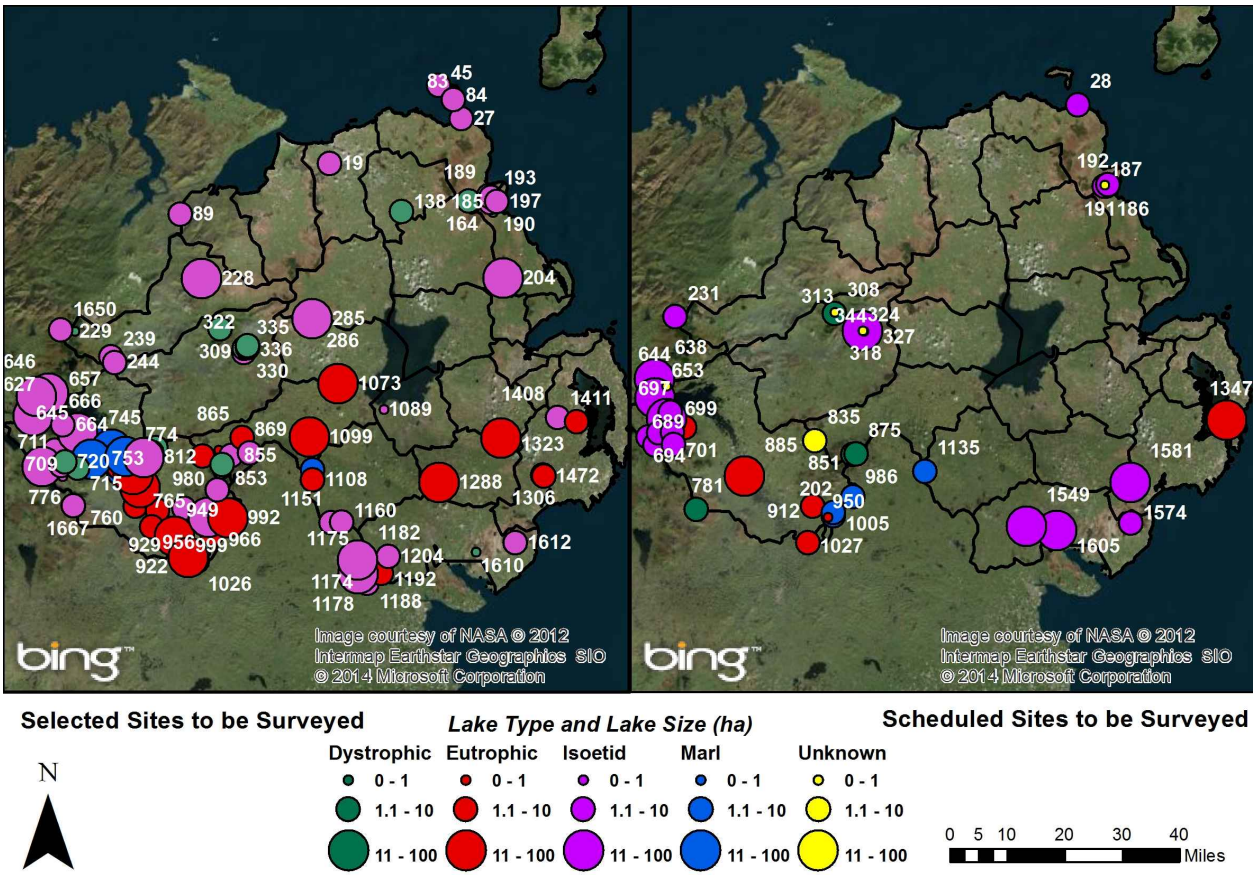


Table 3 Sites nominated for survey using stratified random selection (n=100)

Lough Name	NI Lake No	Grid Ref	Type	Altitude (m amsl)	Area (ha)
Dunalis Reservoir	19	C805305	Isoetid	90	4.0
Lough Doo	27	D174432	Isoetid	155	4.25
Ally Lough	83	D151492	Isoetid	30	1.0
Ushet Lough	84	D152485	Isoetid	30	10.0
Lough Naroon	138	D006171	Dystrophic	205	1.5
Loughnafanoghy	164	D194200	Dystrophic	280	1.5
Craigfad A	179	D263168	Dystrophic	340	1.0
Un-named	183	D231192	Isoetid	335	0.5
Loughascraban	185	D248199	Isoetid	350	1.0
Natullig Lough	189	D250215	Isoetid	370	6.25
Lough Fad	190	D255196	Isoetid	345	3.75
Loughnacally	193	D257211	Isoetid	345	1.5
Loughnatrosk	197	D273199	Isoetid	290	3.5
Killylane Reservoir	204	J290984	Isoetid	265	23.0
Moor Lough	228	H447983	Isoetid	180	13.0
Loughnakinroey	229	H092834	Dystrophic	190	1.0

Lough Name	NI Lake No	Grid Ref	Type	Altitude (m amsl)	Area (ha)
Lough Mulken	239	H193763	Isoetid	190	1.5
Lough Any	244	H203748	Isoetid	185	1.5
Lough Lee	247	H255761	Isoetid	300	15.5
Lough Fea	285	H756870	Isoetid	225	51.25
The Fly Lough	286	H761858	Dystrophic	230	2.0
New Lough	309	H499842	Dystrophic	165	1.25
Loughanillan	322	H575795	Dystrophic	180	2.0
Loughnapeast	330	H565775	Isoetid	190	4.5
Loughnacree	335	H566787	Dystrophic	195	1.75
Lough Carn	336	H575789	Dystrophic	185	7.75
Keenaghan Lough	627	G975598	Isoetid	55	18.0
Meenaghmore Lough	643	G992642	Isoetid	110	1.25
Fir Lough	645	H013649	Isoetid	110	1.0
Lough Rushen	646	H019662	Isoetid	115	20.5
Lough a Waddy	657	H041644	Isoetid	140	7.5
Parabaun Lough	664	H059572	Isoetid	285	3.25
Bunnahone Lough	666	H100551	Isoetid	75	25.0
Martincrossagh Lough	709	H058428	Isoetid	215	1.0
Lough Namanfin	711	H054458	Isoetid	260	4.0
Lough Mulderg	715	H100451	Dystrophic	325	2.0
Lough Acrottan	720	H064469	Dystrophic	330	1.5
Ballaghmore Lough	735	H216438	Marl	45	3
Kinarla Lough	742	H215453	Eutrophic	45	2.5
Castlehume Lough	745	H195505	Marl	45	51
Lough Aleen	751	H139545	Marl	45	6.0
Carran Lough	753	H139477	Marl	55	25.0
Drumcullion Lough	760	H275397	Eutrophic	45	22.0
Lough Yoan	763	H253423	Marl	45	13.0
Lough Coole	765	H255434	Eutrophic	50	11.0
Lattone Lough	776	H001455	Isoetid	75	30.0
Killee Lough	810	H295504	Eutrophic	145	3.0
Ballydoolagh Lough	812	H285481	Isoetid	135	17.25
Mulshane Lough	815	H319509	Dystrophic	175	1.5
Watsons Lough	816	H308496	Isoetid	165	3.5
Lough Fadda	836	H450485	Eutrophic	100	4.0
Lough Natroy	853	H505462	Dystrophic	275	1.25
Cloghcor Lough	855	H530487	Isoetid	140	1.25
Lough Gunnell	857	H495501	Eutrophic	95	1.0
Augher Lough	865	H560537	Eutrophic	60	8.75
Carrickavoy Lough	869	H582494	Isoetid	165	1.5
Sessiagh	903	H261345	Eutrophic	45	8.5
Lough Digh	909	H324333	Eutrophic	55	7.0
Drummully Lough	914	H307287	Eutrophic	45	8.25
Kilturk Lough	922	H371260	Eutrophic	45	46.0

Lough Name	NI Lake No	Grid Ref	Type	Altitude (m amsl)	Area (ha)
Friars Lough	929	H368271	Eutrophic	45	10.0
Lough Narye	937	H398338	Isoetid	140	7.5
Knockballymore A	949	H476268	Eutrophic	45	2.0
Back Lough	956	H458307	Eutrophic	85	4.0
Mill Lough	966	H466313	Isoetid	85	18.25
Lough Asladee	980	H491391	Isoetid	250	4.0
Inver Lough	992	H520312	Eutrophic	65	12.75
Rose Lough	999	H512298	Eutrophic	65	1.5
Corraharra	1012	H356228	Eutrophic	45	0.5
Castle Lough	1026	H409201	Eutrophic	45	27.5
Lough Garrow	1032	H435190	Marl	45	5.0
Roughan Lough	1073	H828688	Eutrophic	60	16.0
Eskragh Lough	1082	H772618	Isoetid	95	15.75
Derrylard Quarry	1089	H958615	Isoetid	20	1.0
Brantry Lough	1099	H749539	Eutrophic	105	17.5
Un-named (Caledon)	1104	H757447	Marl	35	2.25
Tynan abbey Lake	1108	H758418	Eutrophic	35	3.25
Straghans Lough	1147	H823307	Isoetid	155	7.0
Crossbane Lough	1151	H809299	Isoetid	180	1.75
Gentle Owen's Lake	1160	H839300	Isoetid	195	8.5
Sheetrim Lough	1174	H907194	Isoetid	105	2.0
DrumLougher Lough	1175	H895187	Isoetid	115	2.5
Lough ross	1178	H885155	Isoetid	85	90.25
Lough patrick	1182	H884193	Isoetid	95	24.0
Cappagh Lough	1188	H910129	Isoetid	105	2.0
Lurgan Lough Upper	1192	H950157	Eutrophic	135	1.5
Cashel Lough Lower	1204	H969204	Isoetid	135	2.0
Lough Brickland	1288	J111411	Eutrophic	95	14.25
Upper Lake	1306	J402432	Eutrophic	65	9.0
Aghery Lough	1323	J285536	Eutrophic	115	29.5
Aughnadarragh Lough	1408	J443594	Isoetid	65	2.25
Heron Lough	1411	J497582	Eutrophic	30	5.0
Lower Lake Leaforde	1472	J404429	Eutrophic	55	5.0
Un-named	1595	J006169	Isoetid	120	1.0
Unnamed (Kilbroney)	1610	J215216	Dystrophic	345	1.0
Binnian Lough	1612	J325242	Isoetid	455	1.5
Lough Nabrickboy (B)	1635	H036502	Isoetid	205	1.25
Innaghachola Lough	1650	H053839	Isoetid	340	1.5
Loughnapeast	1654	H575794	Dystrophic	180	2.0
Legalough	1667	H088346	Isoetid	170	2.0

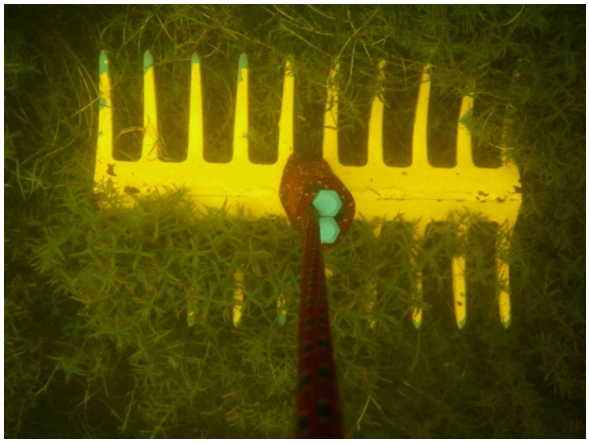
2.2. Common Standards Monitoring - Macrophytes

The timing of this project was such that it spanned the release of the updated CSM guidance for freshwater lakes which was published in March 2015 (JNCC 2015).

This made little difference to the methods for collecting data, but in places interpretation has required explanation from both the original CSM version (JNCC 2005) where still relevant as well as the current 2015 version.

The full description of the survey methods used to collect macrophyte data are therefore detailed in the Joint Nature Conservation Committee publication for the CSM guidance for standing waters (see JNCC 2005 & 2015). In brief, the plant surveys consisted of four components; a strandline survey, emergent and marginal survey, shoreline wader survey and boat survey. These are normally carried out at each site on four discrete 100 m sections of shoreline which are considered to be representative of the lake and give good geographical coverage. In order to reduce disturbance, a maximum of 25% of the shoreline was surveyed, often resulting in less than four sections being selected at smaller loughs.

Figure 2 Sampling methods: bathyscope (a) and double-headed rake (b)



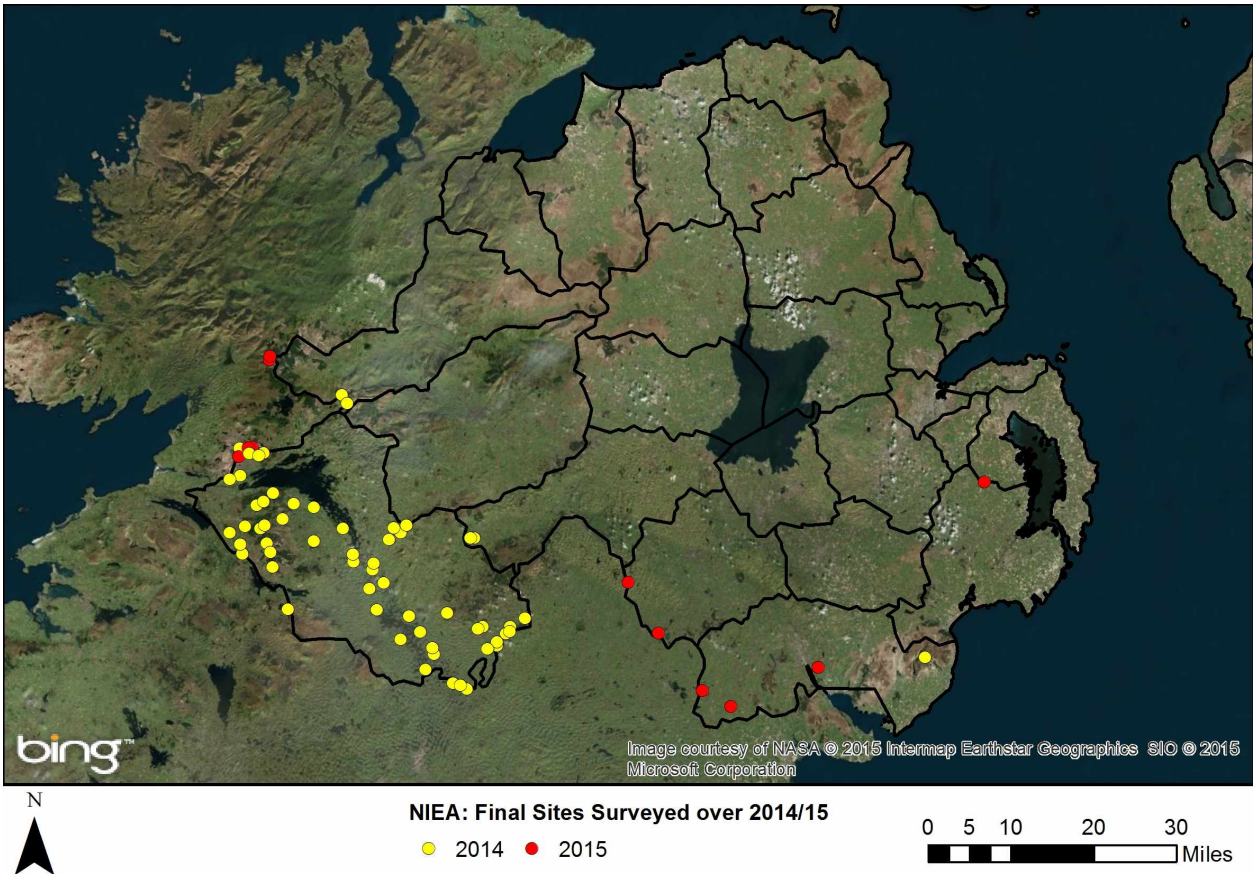
Where possible, surveying was performed using a bathyscope (Figure 2 a), but a double-headed rake (grapnel, Figure 2 b) was also deployed in deeper water or where poor water clarity restricted visibility. The location of all survey sections and boat transects was recorded using Global Positioning System (GPS), backed up with digital photographs, all of which are provided in the data appendices. All boats and survey equipment were cleaned between sites using an approved aquatic disinfectant (Virkon AQ), with additional care being taken where alien plant species were present (e.g. *Elodea* spp.). Sites where zebra mussels (*Dreissena polymorpha*) were observed (e.g. Lough Erne system), or where crayfish (*Austropotamobius pallipes*) were known to occur were treated with additional care to ensure complete disinfection.

It should be stressed that by choosing only representative sections from a lough, these methods do not attempt to gain a complete species list for a site, but instead have been devised to provide quantitative data of low subjectivity that can be obtained in a pragmatic and repeatable manner (Gunn *et al.* 2004). The technique optimises the chance of recording those species most typical of a lough site and detecting marked changes in their frequency. While additional efforts were made to record other species which did not occur in any of the survey sections, the absence of species expected or known to occur from a particular lake does not necessarily denote absence from that site.

The specified survey methods only record presence/absence data for all but emergent and marginal species and therefore accurate plant abundance and cover scores cannot be allocated for the lakes. Plant data are therefore presented as "frequency" of occurrence rather than abundance, and it should be noted that this is frequency within the survey sections, and not for the entire site. While some parallels may be drawn between the CSM surveys and those collected with other survey methods (e.g. NILS) it is important that data are not directly compared. Data from this study are directly comparable with the 2006 CSM results where available (Goldsmith *et al.* 2008), but only general comment is made when comparing data from the Northern Ireland Lake Survey (NILS, 1988-91). In some cases trends are apparent but due to the employment of very different survey techniques, no firm conclusions have been made.

Where possible, all macrophyte identification was conducted in the field under the supervision of Dr Ben Goldsmith (JNCC accredited). Voucher specimens were collected for all taxonomically ambiguous species, unless very rare, and identifications confirmed either from fresh materials (usually in the evening of the survey) or at a later date from pressed specimens. Vouchers of charophytes, and *Utricularia* spp. were preserved in alcohol (IMS) and sent to Nick Stewart for species confirmation. Quality control was performed in-house with reference to previously collected herbaria specimens and where necessary in consultation with an external expert (Nick Stewart).

Figure 3 Map of aquatic macrophyte survey sites 2014 and 2015



Botanical nomenclature followed that of Stace (1997) with the exception of one update used to comply with the CEH Biological Records Centre species list which was used to populate the plant database. *Potamogeton lucens* x *P. gramineus* was previously named *P.* x *zizii*, but has more recently been assigned to *P.* x *angustifolius* after work conducted of the naming of the *Potamogeton* species by Kaplan (1997). All field data were recorded onto standard forms printed onto waterproof paper and transferred on to a Microsoft Access database specifically designed to hold CSM records (Mike Hughes, UCL).

Following the withdrawal of funding, only 71 of the 145 sites underwent macrophyte survey and subsequent assessment (Table 4). Because of the original plan to survey sites in the south and west of the country in 2014 and the remainder in 2015, the resultant coverage was biased towards the SW of the region (Figure 3).

Table 4 Aquatic macrophyte survey sites 2014 and 2015.

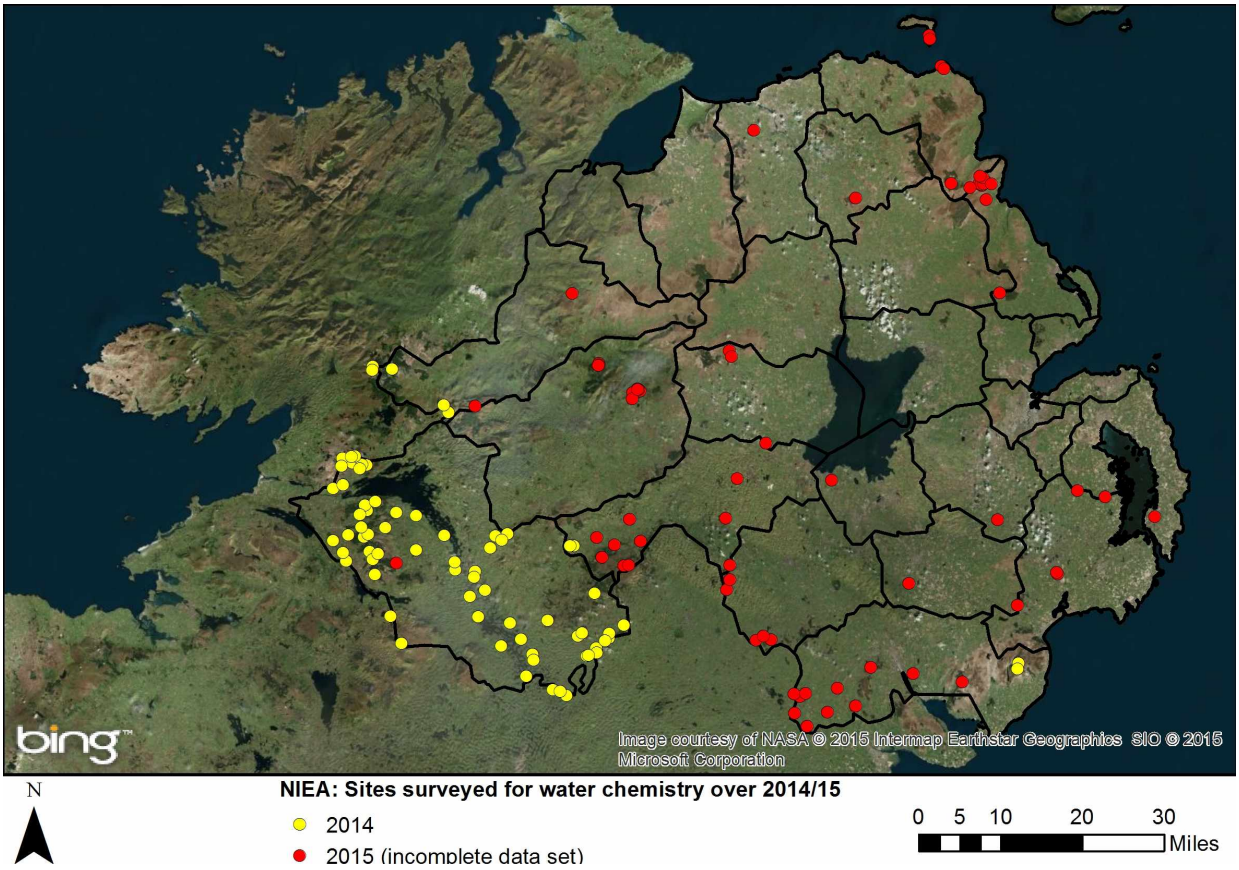
Lough Name	NI Lake No	Grid Ref	Type	Selection	Survey date
Burdautien Lough	202	H494283	Marl	Designated	30/06/2014
Lough Mulken	239	H193763	Isoetid	Random	02/08/2014
Lough Any	244	H203748	Isoetid	Random	02/08/2014
Keenaghan Lough	627	G975598	Isoetid	Random	21/08/2014
Lough Achork	630	H042555	Isoetid	Designated	29/06/2014
Lough Vearty	638	G994658	Isoetid	Designated	28/08/2014
Fir Lough	645	H013649	Isoetid	Random	30/08/2014
Lough Nafeola	654	H032645	Isoetid	Designated	26/08/2014
Lough a Waddy	657	H041644	Isoetid	Random	26/08/2014
Parabaun Lough	664	H059572	Isoetid	Random	29/06/2014
Bunnahone Lough	666	H100551	Isoetid	Random	09/07/2014
Lough Aleater	682	G975495	Isoetid	Designated	05/08/2014
Lough Anierin	689	G995472	Isoetid	Designated	07/08/2014
Lough Navar	690	H028547	Isoetid	Designated	04/08/2014
Derrynacarbit Lough	694	H005506	Isoetid	Designated	05/08/2014
Lough Doo	697	H038565	Isoetid	Designated	06/08/2014
Tullywannia Lough	699	H044508	Isoetid	Designated	06/08/2014
Lough Formal	701	H047474	Isoetid	Designated	29/08/2014
Martincrossagh Lough	709	H058428	Isoetid	Random	29/08/2014
Lough Namanfin	711	H054458	Isoetid	Random	29/08/2014
Doagh Lough	722	H078521	Eutrophic	Designated	07/08/2014
Ballaghmore Lough	735	H216438	Marl	Random	04/07/2014
Kinarla Lough	742	H215453	Eutrophic	Random	04/07/2014
Castlehume Lough	745	H195505	Marl	Random	01/08/2014
Lough Aleen	751	H139545	Marl	Random	04/08/2014
Carran Lough	753	H139477	Marl	Random	06/07/2014
Drumcullion Lough	760	H275397	Eutrophic	Random	07/07/2014
Lough Yoan	763	H253423	Marl	Random	01/07/2014
Lough Coole	765	H255434	Eutrophic	Random	01/07/2014

Lough Name	NI Lake No	Grid Ref	Type	Selection	Survey date
Lattone Lough	776	H001455	Isoetid	Random	26/08/2014
Killee Lough	810	H295504	Eutrophic	Random	08/07/2014
Ballydoolagh Lough	812	H285481	Isoetid	Random	03/07/2014
Mulshane Lough	815	H319509	Dystrophic	Random	04/08/2014
Watsons Lough	816	H308496	Isoetid	Random	08/07/2014
Round Lough	835	H443485	Eutrophic	Designated	28/06/2014
Lough Fadda	836	H450485	Eutrophic	Random	28/06/2014
Mill Lough	885	H245385	Eutrophic	Designated	07/07/2014
Sessiagh	903	H261345	Eutrophic	Random	31/07/2014
Lough Digh	909	H324333	Eutrophic	Random	28/07/2014
Lough Doo	912	H346301	Eutrophic	Designated	28/07/2014
Drummully Lough	914	H307287	Eutrophic	Random	29/07/2014
Kilturk Lough	922	H371260	Eutrophic	Random	26/07/2014
Friars Lough	929	H368271	Eutrophic	Random	27/07/2014
Lough Narye	937	H398338	Isoetid	Random	29/07/2014
Knockballymore A	949	H476268	Eutrophic	Random	06/07/2014
Knockballymore B	950	H479269	Eutrophic	Designated	06/07/2014
Back Lough	956	H458307	Eutrophic	Random	30/07/2014
Mill Lough	966	H466313	Isoetid	Random	30/07/2014
Drumacrittin Lough	986	H549328	Marl	Designated	05/07/2014
Inver Lough	992	H520312	Eutrophic	Random	03/07/2014
Annachullion Lough	997	H519303	Marl	Designated	02/07/2014
Rose Lough	999	H512298	Eutrophic	Random	02/07/2014
Kilroosky Lough	1005	H495274	Marl	Designated	30/06/2014
Corraharra	1012	H356228	Eutrophic	Random	05/07/2014
Castle Lough	1026	H409201	Eutrophic	Random	01/08/2014
Lough Sarah	1027	H423198	Eutrophic	Designated	02/08/2014
Lough Garrow	1032	H435190	Marl	Random	31/07/2014
Blue Lough	1574	J327253	Isoetid	Designated	28/08/2014
Lough Nabrickboy (B)	1635	H036502	Isoetid	Random	06/08/2014
Legalough	1667	H088346	Isoetid	Random	05/07/2014
Loughnaweelagh	231	H052832	Isoetid	Designated	16/06/2015
Meenaghmore Lough	643	G992642	Isoetid	Random	17/06/2015
Mallybreen Lough	644	H011661	Isoetid	Designated	17/06/2015
Lough Rushen	646	H019662	Isoetid	Random	17/06/2015
Tullybrick Lough	1135	H751398	Marl	Designated	18/06/2015
Crossbane Lough	1151	H809299	Isoetid	Random	18/06/2015
DrumLougher Lough	1175	H895187	Isoetid	Random	21/06/2015
Lurgan Lough Upper	1192	H950157	Eutrophic	Random	19/06/2015
Aughnadarragh Lough	1408	J443594	Isoetid	Random	21/06/2015
Greenan Lough	1605	J119233	Isoetid	Designated	20/06/2015
Innaghachola Lough	1650	H053839	Isoetid	Random	16/06/2015

2.3. Common Standards Monitoring – Water Quality

It is required as part of the CSM that water quality data are collected and analysed quarterly (as a minimum), where routine collections are not already in place. Water samples were therefore collected by ENSIS staff from a total of 145 standing water bodies. Sample collection was staggered over 2 periods. Tranche 1 started in April 2014 at 75 sites, with further samples in July/August, November and February 2015. Tranche 2, the remaining 70 sites, were first sampled in November 2014 with further samples in February and April 2015 (Figure 4). The final quarter of tranche 2 sites was not sampled due to the withdrawal of funding by the Northern Ireland Executive.

Figure 4 Map of lough sites with quarterly chemistry. Sites in red had only 3 samples collected



Due to the large number of sites involved, the deployment of boats was not feasible and therefore a throw bottle was used to obtain representative lough water samples. The beach throw consists of a weighted polypropylene sample bottle, with a buoy attached to a rope 50 cm above the mouth of the bottle. After rinsing 3 times with sample water, the bottle is thrown into the lake from the shore to a distance in excess of 10 m. The weight is sufficient to cause the bottle to just dip under the water surface at first and then descend through the water column as the bottle fills. The buoy holds the full bottle 50 cm below the water surface. The sample is retrieved by pulling the rope. The opening of the sample bottle is large enough to allow the bottle to fill in a reasonable time but small enough to prevent water from entering it when the full bottle is pulled to shore. This method is accepted as the most practical and cost-effective for CSM sampling (JNCC 2015) and has been previously demonstrated by staff at the Freshwater Science Research Group

(FSRG), University of Ulster to return samples of comparable quality to those collected from the centre of the lake using a boat (see Goldsmith *et al.* 2008).

Water sampling was conducted by a team of researchers, with sites being visited in such a way as to minimise the total mileage. Samples were refrigerated as soon as possible after collection, either in cool boxes, or mobile refrigerators and stored at the field base. Chlorophyll *a* samples were filtered on site through Whatman GF/C (1.2 µm) using a 500 ml Nalgene filtration unit (Figure 5). The filtered volume was recorded and the paper folded in half (green side in) and wrapped in a square of aluminium foil (to exclude light) and placed into a sample bag. The filters were refrigerated immediately and frozen at the end of the sampling day. With the exception of Chlorophyll *a,* all water samples were analysed in England by the National Laboratory Service, the Environment Agency's analytical laboratories (UKAS accredited). Samples were either couriered to the laboratory, or transported directly where the field work was less than a week in duration. Chlorophyll *a* samples were analysed at University College London in the Water Chemistry Laboratory of the Geography Department.

All water samples were collected in dedicated polyethylene bottles supplied by NLS and labelled with a bar coded label which tracks the sample through the analytical process. All samples were field filtered where applicable. A full list of determinands and the units used in the report are given in Table 5.

Figure 5 Water sample collection and Nalgene filtration unit (right)

2.4. Other physical data

Lake area data are derived from the Northern Ireland Lake Inventory supplied by NIEA and quoted in hectares (ha).

A Shoreline development index (SDI) has been calculated for each lake. The SDI is the ratio of the total length of the shoreline to the length of the circumference of a circle, the area of which is equal to the lake (Wetzel & Likens 1990) and has been derived from UKLakes database (Hughes *et al.* 2004). This measurement is of interest within the context of this report because it reflects the potential availability of the littoral zone of a water body and thus the area within which plants can colonise. Lakes with a SDI close to 1.0 are generally close to being circular, whereas lakes with an SDI greater than 2 have more complex and convoluted shorelines and hence a greater potential to support a more diverse littoral community.

Table 5 List of water quality determinands analysed

Chemical Determinand	Abbreviation	Units	MRV*
Total Phosphorus	**TP**	μgl^{-1} as P	1.0
Soluble Reactive Phosphorus	**SRP**	μgl^{-1} as P	1.0
Total Nitrogen	**TN**	mgl^{-1} as N	0.1
Total Oxidised Nitrogen	**TON**	mgl^{-1} as N	0.005
Nitrite	**Nitrite**	mgl^{-1} as N	0.001
Chlorophyll *a*	**Chl *a***	μgl^{-1}	1.0
Dissolved organic carbon	**DOC**	mgl^{-1} as C	0.2
pH	**pH**	pH units	0.05
Alkalinity (pH 4.5)	**Alk**	mgl^{-1} as CO_3^{2-}	5.0
Conductivity	**Cond**	μScm^{-1} 20 ºC	10
Calcium	**Ca^{2+}**	mgl^{-1}	0.02
Magnesium	**Mg^{2+}**	mgl^{-1}	0.02
Sodium	**Na^{+}**	mgl^{-1}	0.02
Potassium	**K^{+}**	mgl^{-1}	0.02
Chloride	**Cl^{-}**	mgl^{-1}	1.0
Sulphate	**SO_4^{2-}**	mgl^{-1}	0.02

* MRV = Minimum recordable value

During the summer plant surveys, a dissolved oxygen concentration (DO mgl^{-1}) and temperature (ºC) profile was taken at the deepest recorded point of each site. With the majority of sites being shallow, stratification was not expected, but these data were used to assess oxygen availability within the water column. Readings of DO and temperature were taken at 0.5 m intervals, or at greater intervals where no change was evident.

Secchi depth was recorded at each site during the summer plant surveys. A site measurement was recorded from the deepest point of the lough and further measurements were taken at each survey section at sites where variability in water clarity was observed. A standard 20cm diameter Secchi plate was used and the Secchi depth (Z_s) recorded at the point where the disc disappears from view.

The collection of full Lake Habitat Survey (LHS) data was not undertaken as part of this study, but summary data were collected on a range of physical and habitat features in and around the lake.

2.5. Favourable Condition Assessment

The current data collected for this report have been used to assess each water body for its site condition based upon the CSM methods (JNCC 2005, 2015). Where

previous CSM surveys have been conducted, comparisons have been made using both the original CSM guidance (JNCC 2005) and the updated version (JNCC 2015). In some cases the 2015 updates have resulted in changes to the original assessment whereby direct comparison becomes more complex. An example of this would be sites where *Potamogeton pusillus* or *P. berchtoldii* are present; these were included as characteristic species in the 2005 CSM guidance, but have been excluded in the updated version. Interpretation of such assessments has therefore been discussed on a site by site basis in relation to the updates and directional changes in site condition reported in addition to current status. Data presented in the site condition tables within the report are therefore based on the 2015 guidance. Where any disparities occur due to the changes between the 2005 and 2015 guidance, this is discussed in the text.

Where previous CSM surveys have not been conducted, other available data sources (e.g. NILS data) have been used to suggest possible temporal changes or stability at a site. It is stressed here however, that due to the different methods employed for these surveys, no firm conclusions have been drawn from the data and therefore any comparisons are only used to highlight potential concerns and in places recommend the need for further investigation. At these sites, the CSM assessment provides a baseline from which future monitoring will be able to establish any directional shifts in site condition.

The full method for sites condition assessment is described in the CSM Guidance for Freshwater Lakes (JNCC 2015) with additional information still relevant in the older version (JNCC 2005). In brief, each different Habitats Directive Annex I site type is assessed against a series of attributes for which target values or criteria have been set, these are outlined in below, but reference to the Common Standards Monitoring Guidance for Freshwater Lakes (JNCC 2015) is required for full explanation.

Table 6 CSM Attributes used for site condition assessment (JNCC 2015)

Attribute	Significance and Interpretation	Target
Extent / Surface area	This attribute is to assess changes caused by anthropogenic change such as infilling or drainage resulting in loss of habitat. Changes due to natural successional change are covered under other attributes.	No permanent change to the surface area.
Macrophyte community composition	At least a significant proportion of the vegetated area of the water body should have an expected frequency of characteristic aquatic species for a given lake type. There may be valid reasons why a characteristic species is not present at a site which are considered when applying targets to an individual site.	Requisite number and distribution of characteristic species present. No loss of characteristic species

Attribute	Significance and Interpretation	Target
Negative indicator species	Presence of high impact non-native and / locally absent species is generally unfavourable – see WFD definitions for Northern Ireland (UKTAG 2015). Low impact species, including some native taxa should remain below nuisance levels – excessive growth of non-characteristic species may also be unfavourable (e.g. *P. pectinatus, M. spicatum, J. bulbosus*) and indicative of enrichment. Excessive growths of filamentous algae on lake substrate or macrophytes are indicative of nutrient enrichment and supress plant growth. High (non-charophyte) algal cover is unfavourable	No high impact invasive species. A site is assessed as unfavourable when there is evidence that any non-native species or locally absent species is causing an impact on site integrity Less that 20% of sample points should have scores of ”3” (i.e. > 75% cover)
Macrophyte community structure	Healthy lakes support a range of distinctive vegetation zones, from deep water to fully terrestrial habitat. This structural diversity greatly increases habitat complexity and hence the biodiversity of the lake. Many species require a combination of habitats in order to complete their life cycles. Riparian vegetation also plays a role in regulating water quality and dissipating wave energy. Retaining the vegetation structure, including a well-developed riparian fringe, is important in providing a diversity of habitats within a lake Maximum depth distribution can be a useful indicator of nutrient enrichment or sedimentation, since increased water turbidity will kill plants growing in deepest water first. Maximum depth distribution should be maintained during future visits.	Presence of characteristic zones of vegetation. (Lake type dependent) No deterioration in extent from baseline situation. Where possible, restoration targets should be sought. Where previous data exist, no significant reduction in maximum depth distribution should be observed. Type specific targets apply.
Water quality	Ecosystem structure and functioning in lakes is partly determined by climatic factors and the physical properties of the catchment area. Geology, soils and land use in the drainage basins of lakes determine the chemistry of the water and sediments in these water bodies. Key water quality parameters affecting ecosystem functioning of lakes are pH, alkalinity, phosphorus (P) and nitrogen (N). Specific targets are outlined in more detail below.	See below and JNCC 2015 for more details.

Attribute	Significance and Interpretation	Target
Hydrology	There should be a natural hydrological regime, or at least no change from baseline conditions. There should be no evidence of impact from lowered or artificially raised water levels due to abstraction or increased / reduced flows to in- / out-flows. Determining whether there is an appropriate hydrological regime from a single site visit is difficult, although there may be evidence of major impacts, for example stranded marginal vegetation, exposed lake sediments, or signs of former shorelines. In practice, evidence from site visits requires interpretation with reference to information on known changes to the hydrology of the catchment.	No deterioration in hydrological regime compared with baseline (where evidence exists).
Lake substrate	The distribution of sediment particle size and organic content influences the biology of the lake and will affect the suitability of within-lake habitats for invertebrates and macrophytes, and fish spawning grounds. Increases in sediment loading from activities in the catchment area, or from around the lake shore, may result in the smothering of coarse sediments. Increased inputs of leaf litter, as a result of scrub encroachment, may also be cause for concern, as organic-rich sediments may be a poor rooting medium for macrophytes. Inclusion of hard engineering solutions to lake management may have detrimental effects on lake ecology, replacing natural substrates with imported or man-made materials.	Maintenance of natural and characteristic substrate for the lake type
Sediment load	The sediment loading from the catchment area to a lake occurs due to soil disturbance and precipitation. Natural variation occurs in the sediment loading to different lakes, depending on local conditions. The loss of soil to watercourses is often increased through factors such as lack of vegetation cover, trampling by cattle, inappropriate field drainage and ploughing regimes, type of crop, etc. The organic matter loading may increase because of poor agricultural practice (including slurry spreading and poor farm drainage). Increased sediment loadings may result in clogging of the lake bed, increased siltation in the basin and deoxygenation of sediments. Blockage of coarser substrates with finer sediment restricts water flow-through, while increases in organic matter increase biochemical oxygen demand.	Maintenance of the natural sediment load

Attribute	Significance and Interpretation	Target
Connectivity	Maintaining connectivity within a lake, and between the lake and the surrounding areas, is critically important for the functioning of natural processes and for achieving favourable condition. Mainly assessed with reference to marginal habitats and site management.	At least baseline conditions maintained
Indicators of local distinctiveness	This attribute is intended to cover any site-specific aspects of the habitat feature (forming part of the reason for notification) that are not covered adequately by the previous attributes, or by separate guidance (e.g. for notified species features). This is a discretionary attribute, in that it may not be applicable to every site, but where local distinctiveness has contributed to the selection of a site for standing waters it should be mandatory. Local distinctiveness may refer, for example, to rare plant or invertebrate species, high diversity of Potamogeton or charophyte species, or notable habitat features.	Maintain distinctive elements (e.g. rare species, habitat features) at current extent/levels and/or in current locations

2.6. Water quality and favourable condition assessment: JNCC 2015

Total phosphorus (TP)

Changes in the ecology of a lake, due to anthropogenic nutrient inputs, are often first apparent in the phytoplankton population within the water column. The relationship between increased water column TP concentrations and increased phytoplankton biomass is well-established. Increased loadings of P to a lake are likely to lead to higher algal biomass in the water column, which in turn can have significant impacts on the lake ecosystem through, for example, competition with vascular plants for nutrients and light, changes in pH, oxygen depletion and production of toxins. Decreasing dissolved oxygen and increasing ammonia levels are associated with death and decay of algal blooms, as is a release of toxins from toxin-producing species. It is therefore important to include TP levels in condition assessment.

Increases in nutrient levels increase the risk of a switch from a macrophyte dominated state, to an algal dominated one. This may occur, for example, as a result of increases in biomass of phytoplankton or filamentous algae, changes in algal community structure or in the fish community. Hence, while increases in nutrient concentrations alone do not constitute eutrophication, any increase beyond the targets outlined below represents an unacceptable risk to site integrity.

Data availability: For all the loughs in this study some past data exists. Many of the sites were assessed as part of the Phase 1 site condition assessment and therefore have quarterly TP measurements taken in 2006/7 (Goldsmith *et al.* 2008). All of the lakes selected in this project also have TP data collected during the Northern Ireland Lake Survey between 1988-1991 (NILS) although caution should be exercised in using these data which were mainly determined from a single sample. Current sampling collected quarterly water chemistry, including TP, from the majority of survey sites over a full year. A subset of sites had only three measurements taken

due to the changes to the funding allocation made by the Northern Ireland Executive. Confidence in water quality parameters is therefore reduced at these sites and the results discussed in the text.

Setting targets: Type-specific targets have been developed (Table 7) but site-specific targets should be set for each lake where possible. This approach is necessary because type-specific targets are relatively broad. When setting targets for a WFD water body an additional test of stringency needs to be applied (see 'Use of WFD Standard' below).

The WFD typology is defined by alkalinity and mean lake depth (Table 7). TP levels have been considered with respect to depth, as the bathymetric properties of lake basins influence the resident ecological communities. The link between alkalinity and types of lake is long established. Low alkalinity lakes tend to be nutrient and species poor, while high alkalinity lakes tend to be richer in nutrients, flora and fauna. However, since high alkalinity lakes are usually in lowland areas, they are also subject to a higher level of impact.

Type-specific targets: Generally, the capacity of a lake to immobilise P increases with increasing alkalinity, as the concentrations of cations that may bind with P increase. In lakes with higher alkalinity, the capacity for immobilisation of P, combined with the presence of a stable macrophyte community, discourages augmentation of algal biomass. Hence targets for low, medium and high alkalinity lakes are different.

For mesotrophic, hard water and eutrophic lake types, different targets are presented for *deeper* (WFD 'shallow' and 'deep' types) and *very shallow* water bodies. The upper limit for very shallow waters of these lake types is higher than that for deeper waters. This is because very shallow lakes usually have a higher carrying capacity for nutrient enrichment. For peaty and low alkalinity lakes in particular, this is not necessarily the case, so the targets do not vary with depth. Small changes in TP levels of lakes with naturally low TP concentrations can have significant effects, particularly on phytoplankton ecology, and in very shallow lakes a high proportion of the water column receives sufficient light to support photosynthesis, so is a potential habitat for algae.

Targets for deeper medium and high alkalinity lakes are more stringent than those for shallow waters, recognising that:

- in deeper lakes, a smaller proportion of the water volume is occupied by macrophytes, and hence there may be greater potential for algal blooms to develop;
- retention times in deeper lakes are generally longer;
- in deeper lakes there is greater potential for P to be lost to the sediment or hypolimnion; thus, for a given P load the expression of P concentration in the water column may be lower in a deeper lake, while masking a potential problem of accumulation of P in the sediment or hypolimnion.

However, it is important to consider the characteristics of the individual lake, as more stringent targets may be required in certain very shallow lakes, depending on the proportion of the water column that is a potential habitat for algae.

Lakes with hard water have a high capacity for P immobilisation due to co-precipitation of P with calcium and / or magnesium. Thus, P concentrations are typically low in these lakes, even when they are receiving relatively high external P loads (Wiik 2012). As a result of better scientific evidence of the impact of P within hard water lakes, the CSM targets have been lowered within the 2015 guidance from 20 μgl^{-1} to 10 μgl^{-1} in deeper lakes and 35 μgl^{-1} to 15 μgl^{-1} in very shallow lakes (JNCC 2005, 2015).

Table 7 CSM Total phosphorus targets and corresponding WFD typology

Lake habitat feature type	Depth Category	Maximum Annual Mean TP (μgl^{-1} as P)	Approximate match to WFD typology
Dystrophic	All	10	Peat
Oligotrophic	All	10	Low Alkalinity
Mesotrophic	Deeper Very Shallow	15 20	Moderate Alkalinity
Hard water	Deeper Very Shallow	10 15	Marl
Eutrophic	Deeper Very Shallow	35 50	High Alkalinity
Brackish	All	35	Brackish

In peat dominated catchments, TP may exist in humic–iron–P complexes. Additional P from anthropogenic sources does not bind well with sediments of low pH and high organic content, such as may be found in these water bodies. Although there is reduced light penetration, increases in algal biomass remain possible, as certain algal types (e.g. species of blue-green algae), are suited to harvesting light under such conditions and / or may have P uptake strategies that are more suited to utilisation of the additional P source. Therefore, in dystrophic lakes and those with high humic content (evidenced by brown water), a slightly elevated TP concentration (up to 25 μgl^{-1}) should not be used on its own to place the site in unfavourable condition, especially where there is no evidence of external nutrient sources in the catchment.

The upper limits for TP levels are presented for each lake type in Table 7. Lake depth categories are based on mean depth and are: 3 m or less = very shallow; >3 m = deeper (this is a combination of the WFD ‘shallow’ (>3-15 m) and ‘deep’ (>15 m) types).

Site-specific targets: The setting of site-specific targets is beyond the scope of this project, but where there are good water quality and/or biological data, or evidence from palaeolimnology, that a target outside the type-specific range is more appropriate, a site-specific target may be used to reflect this. In this report, recommendations are presented for this at some sites where it is felt the water quality (and / or plant community) is atypical of the type for reasons other than anthropogenic disturbance. Similarly, for lakes recovering from historical nutrient enrichment, it may be necessary to set interim targets that are different from those in

Table 7. These are likely to be site-specific and will require further investigative work, such as estimation of nutrient budgets and sediment sampling. Setting these targets is outside the scope of this project.

Nitrogen

It has previously been recommended that nitrogen targets are only required for lakes that are nitrogen limited, but this neglects the impact of nitrogen on macrophytes. There is evidence that high nitrogen concentrations are detrimental to macrophyte diversity and abundance, charophyte growth and the persistence of *Phragmites australis*. Although these studies suggest that it is nitrate which causes this effect, nitrate can fall below levels of detection due to denitrification and uptake, particularly in the summer months. Consequently, the mean annual total nitrogen concentration is used as a surrogate to assess nitrate loading (). Therefore, regardless of which nutrient is limited, mean annual total nitrogen concentrations above 1.5 mgl^{-1} should lead to an assessment of unfavourable condition, as suggested by Barker *et al.* (2008).

Table 8 Nitrogen targets

Lake type	Target
All lakes	Annual mean total nitrogen concentration should not exceed 1.5 mgl^{-1}. No deterioration from baseline.
Nitrogen-limited lakes and lakes where reduction in nitrogen concentration can contribute to the control of algal growth.	Targets should be set in consultation with technical specialists.

More stringent nitrogen targets may be required to limit algal growth to concentrations typical of the lake type, particularly in naturally unproductive lakes. This will need to be considered for lakes currently limited by nitrogen and lakes that are currently not limited by phosphorus or nitrogen, but where reduction in nitrogen concentration can contribute to the control of algal growth. The potential for nitrogen and phosphorus to limit productivity at different times in the year should also be considered. These targets should be set in consultation with technical specialists.

Chlorophyll a

Chlorophyll *a* is a pigment used for photosynthesis by plants, so the concentration of chlorophyll *a* in the water column during the growing season provides a good indicator of the abundance of phytoplankton which is an important driver of structure and functioning in lake ecosystems. High phytoplankton biomass (algal blooms) is usually associated with nutrient enrichment and increased sedimentation in lakes.

Phytoplankton growth in lakes is variable. Variability is high in enriched water bodies. However, in naturally nutrient-poor lakes, phytoplankton abundance is more stable. Due to variability in plant growth, a single monitoring visit will not provide evidence of change. Even in enriched waters, a clear water period is to be expected and, conversely, blooms sometimes occur under natural conditions, for example following long periods of dry weather.

The UK Government has set type-specific standards for chlorophyll *a* concentrations. However, as with TP targets, site-specific chlorophyll *a* targets are preferable to lake

type targets, as they take into consideration the individual characteristics of a lake. While these provide a better target, methods developed by the UK environment agencies for WFD assessment (WFD-UKTAG 2014) require monthly sampling and this therefore falls outside the scope of this project. If a site is in favourable condition, current chlorophyll *a* data can be used to set a target for no deterioration (i.e. a baseline). If a site is in unfavourable condition, historical data may be used to inform target setting.

Chlorophyll *a* data is interpreted in combination with macrophyte depth distribution, nutrient concentrations and Secchi depth to give an impression of the extent of nutrient impacts on the lake.

Dissolved oxygen

Anthropogenic activities leading to phytoplankton blooms and increased loadings of organic matter in lakes can cause decreases in the concentration of dissolved oxygen available to support the species present. Within the updated CSM guidance (JNCC 2015) the WFD standards have been adopted. The standard divides lakes into salmonid and cyprinid waters, reflecting the different environmental tolerances of these fish groups. The values for good ecological status (GES) were developed for July and August, i.e. the time of year when DO levels are likely to be lowest. If the lake already meets the standard for high ecological status (HES) then this target should be adopted in order to prevent deterioration.

In monitoring for WFD-related purposes, DO values are measured at 0.5 m depth intervals in July or August. When a lake stratifies, i.e. there is a significant temperature gradient between the top and bottom of the water column, the target refers to the mean DO concentration below the thermocline only. Where the lake does not stratify, the target is the mean of all dissolved oxygen readings throughout the water column. Table 9 indicates the appropriate target for lake types irrespective of their fish community.

Table 9 Dissolved oxygen targets

Lake type	GES	HES
Dystrophic, oligotrophic, mesotrophic, hard (salmonid waters)	>7.0 mgl^{-1}	>9.0 mgl^{-1}
Eutrophic (cyprinid waters)	>6.0 mgl^{-1}	>8.0 mgl^{-1}

pH

pH is an important variable, as it influences all chemical and biological processes in lakes, e.g. P binding in sediments, sources of carbon for photosynthesis, chemical speciation and the development of toxic effects of pollutants. Changes in pH, either through eutrophication or acidification can, therefore, have considerable effects on lake ecology. The optimum pH range for fish health is pH 5.5–9.0, although pH values of between 5.0 and 5.5 are not generally directly toxic to fish. However, many dystrophic lakes may not support fish, due to naturally acidic conditions.

The pH values presented in Table 10 are for guidance only and sites falling outside these do not automatically classify a lake as unfavourable. It is recognised that there are difficulties with setting targets for pH in lakes due to daily and seasonal variation

that occur for a number of reasons caused by e.g. snowmelt leading to acid pulses, and photosynthesis causing high pH during the day. These factors make target setting and interpretation of pH problematic.

Table 10 Guideline pH values associated with different lake types

Lake type	Guideline pH (annual mean)
Dystrophic	<5.0
Oligotrophic (sandy plains)	5.5 to 7.0
Oligotrophic	5.5 to 7.0
Mesotrophic	6.5 to 8.0
Hard	7.0 to 8.5
Eutrophic	>7.0 to <9.0

Although there are difficulties in developing type-specific standards, it is possible to set site-specific targets. In many lakes of low nutrient status, variability in pH is generally limited and values are low, so where pH ranges are highly variable and exhibit high values this is an indication that the feature is in unfavourable condition. Conversely, mesotrophic, hard and eutrophic lakes may be in unfavourable condition if low pH values are present in the water column. Values for pH in hard water systems would be expected to be stable, so an increase in variability would suggest problems at the site. In general, high variability in pH may be associated with unfavourable condition. With the exception of dystrophic lakes, pH would not be expected to be at values that would result in toxicity to biota. Toxicity may occur at both low and high pH. There are reasons, therefore, why an individual feature may be judged to be in unfavourable condition with regard to pH, in the context of having a reliable set of monitoring data, rather than an individual measurement.

It should be noted that the values for “mean” pH quoted within this report are not arithmetic means of the pH values, but instead are calculated by transforming the pH to H+ ion concentration ($[H^+] = 10^{-pH}$) taking the arithmetic mean of [H+] values, and then back-transforming the mean to pH ($pH = -\log_{10}[H^+]$).

2.7. Trophic Scores (PLEX & TRS)

In addition to the CSM attributes, trophic scores have also been applied to the plant data. Trophic scores are a method designed to infer the ecological condition of standing waters using the composition of the submerged plant community. Scoring systems such as this use observed nutrient preferences of the plant community to infer the trophic status of the lake. These systems have been used in rivers with some success (e.g. Holmes *et al*. 1998, Schneider & Melzer 2003), and in the UK, a modified form of this system (LEAFPACs) has recently been developed as a WFD tool for both rivers and lakes (Willby *et al*. 2006) and these methods have recently been assessed alongside large European datasets (Penning *et al*. 2008).

Trophic scores are not a formal part of the CSM methods, but have been presented here to provide additional contextual information. Two different trophic scores have been calculated: Trophic Ranking Score (Palmer, 1992) and the Plant Lake Ecosystem Index (PLEX Duigan *et al*., 2006). Trophic Ranking Scores (TRS – Palmer, 1992) were calculated from presence / absence data. In additions to TRS scores, Plant Lake Ecosystem Index (PLEX) scores (Duigan *et al*., 2006) have been

calculated for each lake. PLEX is essentially a development of the older TRS system, but has been developed using a larger dataset and incorporates a greater range of species. These values have been included here to assist with detecting change over time at individual sites.

Although trophic scores may provide useful, easily accessible information, all of these trophic scores need to be interpreted with caution. Macrophyte communities respond to various factors, of which nutrients are often not the most important (Demars & Harper, 1998). The ability of any macrophyte community to reflect changes in nutrient loading will depend on the species pool present, and many macrophyte species have a broad nutrient tolerance, making them relatively poor indicators of trophic status (Holmes *et al*., 1999). Macrophyte populations in stressed communities may also fluctuate widely and unpredictably (Jeppesen *et al.*, 2005). Consequently, the trophic indices have not been used directly as part of the condition assessments, but instead they provide a means of general comparison between sites and between the current surveys, those conducted in 2006 (Goldsmith *et al.* 2008) and the NILS data (1988-1990).

2.8. Overall assessment: JNCC 2015

The assessments made in this report are made primarily from the data amassed from the field sampling. Hence the importance of the standardisation of survey and analytical methods and setting of scientifically-based targets. During the interpretation of these data however, there are numerous cases where one or more water quality attributes is exceeded or a site falls just short of the required ecological target set for its type. In such cases the attributes are considered in a wider context to include information from the local area and any other evidence gathered from the field sites, as well as other sources (maps, literature, anglers, NIAE, aerial photography) in order to justify the assessment. The following text is provided within the updated CSM guidance in order to steer site assessments towards the most satisfactory and accurate outcome for individual lakes sites and ASSI and SAC features where a number of lakes occur.

> There may be valid reasons why such results occur comes very close to targets set out in the CSM narrow any assessment, data provide Lakes respond in a wide variety of ways to environmental pressures, and different attributes inherently need different interpretation. Different attributes are detectable at different levels of confidence, and reflect pressures over different timescales. No one attribute is necessarily a reliable measure of pressure.
>
> A site may be classed as unfavourable if any individual attribute fails to meet its target. However, classing a site as unfavourable based on failure to meet a single attribute runs the risk of drawing the wrong conclusion due to sampling error, site-specific factors, unusual weather conditions or misidentification. Where a single attribute is used to fail a site, careful consideration must be given to the confidence in the data collected for that attribute, the magnitude of any failure and the appropriateness of the target in the context of the setting.
>
> Moreover, lakes tend to respond as a system to pressures and therefore a lake suffering ecological pressures will usually manifest this in more than one attribute. For example, a lake suffering from nutrient enrichment is likely not only to have elevated nutrient levels, but also algal blooms, deoxygenation of deep water areas, and a decline in cover of characteristic macrophyte species. During

> the early stages of impact, these symptoms may not be very pronounced and failures of targets may be small. However, whereas a small failure of a single target may be attributed to measurement error, failure of several related targets – even by quite small margins – should be a trigger for action. In this way a more robust assessment is achieved by using a weight of evidence approach. Whichever approach is used, an understanding of the inherent variability of different methods and the pressures that they detect is required.
>
> If condition assessment is required for a site with many lakes then all monitored lakes should be in favourable condition to report the whole site as favourable. However, expert judgement can be used to decide whether the failure of individual lakes is sufficiently serious to warrant the whole site being classed as unfavourable.
>
> (JNCC 2015)

2.9. List of Abbreviations Used

Depths
Z_{max} = Maximum recorded water depth
Z_s = Secchi depth (recorded during summer survey)
Z_v = Maximum macrophyte colonisation depth (Mean of transects)

Limnological data
TP = total phosphorus
SRP = Soluble reactive phosphorus (equivalent to orthophosphate (PO_4^--P)
TN = total nitrogen
TON = Total oxidised nitrogen (NO_3^- and NO_2^- combined)
Chl *a* = chlorophyll a
Alk = Total alkalinity
DOC = dissolved organic carbon

Habitats Directive standing water body feature types
OML = Oligotrophic to mesotrophic lake with *Littorelletea*
HC = Hard lake with *Chara* spp.
NE = Natural eutrophic lake
DY = Dystrophic lake

Water Framework Directive (WFD) lake typologies
Alkalinity

LA = low alkalinity	<10 mg/l CO_3^{2-}
MA = medium alkalinity	10-50 mg/l CO_3^{2-}
HA = high alkalinity	>50 mg/l CO_3^{2-}

Depth
D = deep (Z_{mean} > 15 m)
Sh = shallow (Z_{mean} 3 – 15 m)
VSh = very shallow (Z_{mean} < 3 m)
“Deeper” = D & Sh combined

General
NILS = Northern Ireland Lake Survey (610 lakes surveyed 1988-1991)

WBID = Water body identification (number)
NI Lake number = Lake identifier from the NI lakes inventory (Smith *et al.* 1991)

3. Site Assessments

3.1. Mulshane Lough (Peat Sh)

Annex 1 type: H3160: Natural dystrophic lakes and ponds.

Survey Date	04 August 2014
NI Lake Number:	815
WBID:	50669
County:	Fermanagh
Grid reference:	H319509
OS Grid reference (X,Y):	231945,350878
Shoreline development index:	1.191
Surface area (ha.):	1.1
Maximum recorded depth (m):	3.4

Table 11 Condition Assessment Summary Table for Mulshane Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Dystrophic: Any characteristic species	✓	2 present: Aquatic *Sphagnum* spp. & *J. bulbosus*
	No loss of characteristic species	✓	No loss since the NILS survey
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-native species recorded
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓?	Small amount (<10%) of filamentous green algae present. *Batrachospermum* spp. frequent

Attribute	Target	Status	Comment
Macrophyte community structure	Characteristic vegetation zones should be present	✓	The bank tops comprise of a species rich bog flora dominated by *Sphagnum* spp. Aquatic *Sphagnum* spp. dominated the submerged flora.
	Maximum depth distribution should be maintained	✓	Z_{max} = 3.4 m, Z_s > 1.3 m, Z_v = 3 m
	At least the present structure should be maintained	✓	Margins dominated by *Sphagnum* spp. and bog vegetation.
Water quality	Stable nutrient levels: TP target / limit 10 μgl^{-1}	**X?**	TP = 13.4 μgl^{-1} (range 8-19) & TN = 0.38 mgl^{-1} (Apr'14 – Feb'15)
	Stable pH values: pH < 5.0	✓	pH = 4.49 (range = 4.4 – 4.6).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	Water column mixed and well oxygenated (>8.0 mgl^{-1}).
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial bloom present.
Hydrology	Natural hydrological regime	✓	Appears natural
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	Predominantly peat
Sediment load	Natural sediment load maintained	✓	No evidence of increased sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	✓	Area of blanket bog.
	Minimal negative impacts and no fish farming	✓	Disturbance / grazing pressure low immediately around the lough. Peat cutting encroaching on the raised bog ~ 200m from the lough shore.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.1 ha, with no loss of extent of open water.

Macrophyte community composition

Mulshane Lough is a shallow water body surrounded by a remnant patch of lowland raised bog. Presumably much of this raised bog has been drained locally as the majority of the surrounding land use is rough pasture with small amounts of forestry, although it is unknown how much these interact with Mulshane Lough's catchment as there is no apparent inflow or outflow. Given the peat dominated catchment the lough has brown water which limits light penetration. Mulshane Lough supports a sparse aquatic macrophyte flora, with only two characteristic species being recorded: *Juncus bulbosus* and *Sphagnum* spp. Only a few *Juncus bulbosus* plants were recorded growing around the margins of the site, the remaining flora consisting of

bryophytes (*Sphagnum* spp. and aquatic liverworts), which were relatively frequent up to 3 m depth. The presence of these characteristic species places Mulshane Lough in favourable condition with respect to the flora.

The aquatic flora of Mulshane Lough is similar to that recorded in the 1988 NILS survey although *Fontinalis antipyretica* was recorded in the NILS survey but not in the most recent survey. *F. antipyretica* can inhabit eutrophic as well as nutrient poor lakes and rivers. Its absence may reflect a minor trophic shift or could just reflect the methodological differences between the NILS and current survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 3.7 and 2.31 respectively. This is lower than the scores calculated for the NILS data due to the absence of *F. antipyretica* in the current survey.

Table 12 Aquatic macrophyte community composition for Mulshane Lough, including trophic scores

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=23)***
Aquatic mosses	-	-	1	-	-	-
Batrachospermum sp.	-	-	-	-	-	4
Fontinalis antipyretica	6.3	5.38	+	-	-	-
Juncus bulbosus	**3.7**	**3.08**	**1**	**3.7**	**3.08**	**8**
Liverworts aquatic	-	-	-	-	-	32
***Sphagnum* (aquatic)**	**3.7**	**1.54**	**5**	**3.7**	**1.54**	**92**
Average score	**4.6**	**3.3**		**3.7**	**2.31**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

No negative indicator species were recorded, and filamentous algae although present, was at low abundance.

Macrophyte community structure

Mulshane Lough has a poorly established flora in very brown waters and being relatively shallow does not exhibit the characteristic zonation seen in deeper, clear water sites. No higher plants were recorded beyond a water depth of ~75 cm. The current structure with aquatic mosses growing in the littoral zone alongside the emergent species, *Carex rostrata* and *J. bulbosus*, giving way to *Calluna vulgaris* away from the edges is considered favourable.

Water quality

Mulshane Lough is a small and shallow (Z_{max} recorded = 3.4 m), dystrophic lake with brown stained water. Its water chemistry is in some ways typical of dystrophic lakes, having low pH (mean pH = 4.5) and ionic concentrations but it also has a rather low

dissolved organic carbon (DOC) concentration (mean = 8.8 mgl^{-1}). August data has been omitted from the results due to an error in sampling. Based on the 3 samples however, total phosphorus is only slightly above the level set in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015) and in the absence of any obvious external inputs is not thought to be indicative of unfavourable conditions. Since there is limited evidence of the effects of nutrient enrichment at the site (e.g. high Chl *a* and/or excessive growth of *J. bulbosus*), Mulshane Lough is considered to be in "favourable condition" with respect to trophic status. Other water quality parameters are consistent with the lake type (i.e. Peat, Sh). At the time of survey, DO was >8.0 mgl^{-1} from 0 – 3.4 m water depth (Figure 6).

Table 13 Water chemistry data for Mulshane Lough. No August sample.

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	18.6	-	13.7	7.9	**13.4**	63
SRP	2.2	-	1.8	1.7	**1.9**	26
TN	0.36	-	0.53	0.26	**0.38**	1.12
TON	<0.005	-	0.010	0.012	**<0.0113**	n/a
Nitrite	0.002	-	<0.001	<0.001	**<0.002**	n/a
Chl *a*	2.75	-	8.47	3.85	**5.02**	11.45
DOC	7.33	-	11.8	7.18	**8.77**	n/a
pH	4.59	-	4.5	4.37	**4.49**	5.88
Alk	<5	-	<5	<5	**<5**	0
Cond	42	-	42	64	**49**	75
Ca^{2+}	<1	-	0.44	0.38	**<0.41**	0.9
Mg^{2+}	0.49	-	0.49	0.85	**0.61**	1.05
Na^{+}	4.64	-	4.72	6.79	**5.38**	7
K^{+}	0.31	-	0.21	0.25	**0.26**	0.45
Cl^{-}	9.4	-	9.1	13.4	**10.63**	16.6
SO_4^{2-}	<10	-	1.22	2.04	**<1.63**	4.95

Hydrology
The hydrological regime at the site appears natural.

Lake substrate
The lake basin is predominantly silt and sand and is consistent with lake type..

Sediment load
Mulshane Lough is surrounded within a ~200m radius by a remnant patch of lowland raised peat bog. Within this radius the land is perhaps grazed and the bog is being cut for peat on its margins but immediately around the lough there is limited activity that would add to the sediment load. No inflows or outflows were apparent and the other land use within the wider area such as improved pasture and forestry may not directly interact with the lakes hydrological regime. No evidence of increased sediment load was noted.

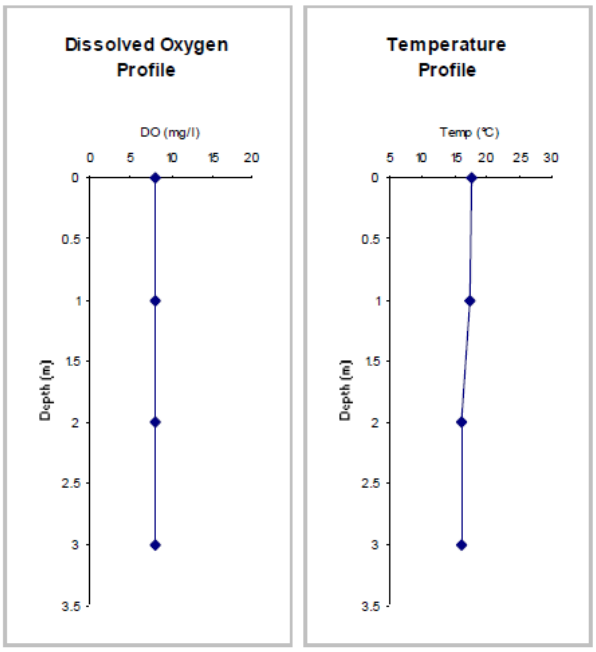
Indicators of local distinctiveness

None specific for a Dystrophic lough but within the locality this type of lake is likely to be rare due to land use change.

Figure 6 Dissolved oxygen and temperature profile for Mulshane Lough (05/08/2014)

GPS Location	H3192450895
Maximum Depth (m)	3.4 m
Secchi Depth (cm)	130 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.12	17.6
1	8.1	17.4
2	8	16
3	8.11	16



Summary

The aquatic plant community of Mulshane Lough is species poor (only 2 characteristic species) but typical for this type of lake. The lake chemistry is fairly typical of a dystrophic water body with relatively low pH and ionic concentrations, although DOC is not as high as might be expected for the type. Mean annual TP is only slightly above target levels and the site shows little evidence of the effects of eutrophication.

Although typical for many upland areas, a dystrophic lake within a lowland agricultural landscape in good condition is rare. Mulshane lough's flora and chemistry is typical and comparable to other dystrophic lakes in more upland areas such as Lough Aleim (NI lake number: 783) in the Cuilcagh Mountain SAC. Pressures such as drainage, peat cutting, forestry and grazing all impact dystrophic lakes. These pressures are generally more intensive and extensive in lowland landscapes, apart from perhaps forestry. Therefore the buffer of intact raised peat bog around Mulshane Lough is facilitating its continued good ecological condition and natural functioning as a dystrophic lake. However, at the time of survey peat cutting with machinery was evident on the margins of the peat bog. If this activity continues to degrade the surrounding bog then the ecology of Mulshane Lough would likely be compromised. Site condition is therefore assessed to be **favourable, at risk**.

Table 14 Mulshane Lough: Overview

Water Body	Status	Reason(s) for at risk	Comments
Mulshane Lough NI Lake 815	**Favourable, at risk**	Encroaching peat cutting may negatively impact the lough if left unchecked. Slightly elevated TP levels and filamentous algal cover present.	A good example of a dystrophic lough in a lowland peat landscape. Raised peat bog with characteristic flora surrounding the lough. Little of this vegetation remains in the surrounding locality (NW of Enniskillen)

Species list

Table 15 List of all plant species recorded at Mulshane Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Betula pendula	R
Calluna vulgaris	R
Carex rostrata	F
Erica cinerea	R
Galium palustre	R
Juncus effusus	0
Sphagnum sp.	F
Submerged & floating species	**% Frequency (n = 25)**
Batrachospermum sp.	4.0
Juncus bulbosus	8.0
Liverworts aquatic	32.0
Sphagnums aquatic	96.0

Survey data

Site Condition Assessment: Mulshane Lough (04/08/2014)

Lake Details		**Survey Details**	
Lake Name	Mulshane Lough	Survey Date	04/08/2014
SSSI Name		Surveyors	SD & AH
SAC Name		Shore Surveys	1 out of
Grid Ref	H319509	Wader Surveys	1 1
WBID / NI No.	50669 / 815	Boat Surveys	1 sections

Site Notes:

Survey Notes:

Section Summaries

Section 1	Maximum depth of colonisation (cm)	300 cm
	Compass bearing of boat transect (°)	289 °
	Lateral distance from waters edge to 75cm depth (m)	2 m
	Notes: Dead moss found at 3.3 + 3.5m.	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H3191030935	H3189150846	H3186350904	H3192150900

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0156	0157	0159

3.2. Loughnaweelagh (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the Isoëto-Nanojuncetea

Survey Date	16 June 2015
NI Lake Number:	231
WBID:	50340
County:	Tyrone
Grid reference:	H052831
OS Grid reference (X,Y):	205150,383115
Shoreline development index:	1.373
Surface area (ha.):	3.4
Maximum recorded depth (m):	7.5

Table 16 Condition Assessment Summary Table for Loughnaweelagh

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓	4 characteristic species present: *L. uniflora, L. dortmana, I. lacustris & U. minor.*
	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	**X**	5 characteristic species present: *L. uniflora, L. dortmana, I. lacustris, N. flexillis agg. & U. minor.*

Attribute	Target	Status	Comment
	No loss of characteristic species	✓?	*S. angustifolium* recorded in the NILS survey but not in the current survey. Different methodologies used so not a direct comparison.
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	✓	83% of vegetated sample spots comply for oligotrophic species. 90% % of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	None present
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Only small amount of filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Loughnaweelagh sits within a large expanse of blanket bog on the border with the RoI. The surrounding vegetation consists predominantly of wet *C. vulgaris/Molinia* heath. Emergent vegetation was very sparse and where present consisted of *L. uniflora* and *J. effusus*. *L. uniflora* present up to 0.75m depth and *L. dortmana* present up to 1m depth. *I. lacustris* occupying deeper water from 0.75 m up to 1.7m depth. *J. bulbosus* present at all depths up to 1.4m. *P. natans* present in both sections. *U. minor* only present in section 1 at depths >0.75m. *M. alterniflorum* present >1.4m depth. *N. flexillis agg*. was recorded up to 2.1 m depth and occupied a zone beyond *I. lacustris*.
	Maximum depth distribution should be maintained	✓	Z_{max} = 7.5 m, Z_s = 3.1m, Z_v = 2.1 m.
	At least the present structure should be maintained	✓	No comparable data.

Attribute	Target	Status	Comment
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1}	✓	TP = 4.82 µgl^{-1} (range 3.2 - 7.1) & TN = 0.27 mgl^{-1} (Apr '14 – Feb '15).
	Stable nutrients levels: TP target / limit: Mesotrophic = 15 µgl-1	✓	
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.71 (range = 6.6 – 6.9).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline	✓	Waters oxygenated throughout water column DO ~9 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of silt, peat, pebble and cobble substrates.
Sediment load	Natural sediment load maintained	✓**?**	The lough sits within a large area of blanket bog. Wind farm nearby Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	
	Minimal negative impacts and no fish farming	✓**?**	Wind farm nearby. No evidence of impact

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 3.4 ha, with no loss of extent of open water.

Macrophyte community composition

Loughnaweelagh is a brown water nutrient poor lough that sits in a large expanse of upland blanket bog. The flora present is characteristic of an oligotrophic upland lough with 4 characteristic species present: *Isoetes lacustris, Littorella uniflora*, *Lobelia dortmana and Utricularia minor.* Other taxa include *Juncus bulbosus, Potamogeton natans, Myriophyllum alterniflorum and Nitella flexilis agg.* The lough was last surveyed in 1990 as part of the NILS programme. The taxa recorded in both surveys are similar although *S. angustifolium* was recorded in the NILS survey but not the current survey. *S. angustifolium* can be patchy in its distribution within a lough so it's possible that the taxa was missed in the current survey. *N. flexilis agg.* was not recorded in the NILS survey. Given its presence in the deeper parts of the lough, if no boat was used then this taxa could be easily missed. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated form the NILS 1988 data, suggesting that the trophic status is stable.

Negative indicator species

No negative indicator species present. Although isolated, the lough is close to wind farm tracks which are well paved. If the public are able to access the wind farm then the lough could be easily accessed by anglers. Gates to the wind farm were unlocked on several occasions throughout the sampling year. This puts the lough at a minor risk from the spread of invasive species if anglers do not perform good biosecurity.

Table 17 Aquatic macrophyte community composition for Loughnaweelagh, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=74)***
Isoetes lacustris	**5.0**	**4.23**	**2**	**5.0**	**4.23**	**45.8**
Juncus bulbosus	3.7	4.23	3	3.7	4.23	66.1
Littorella uniflora	**6.7**	**4.23**	**4**	**6.7**	**4.23**	**33.9**
Liverworts aquatic	-	-	2	-	-	6.8
Lobelia dortmana	**5.0**	**3.08**	**4**	**5.0**	**3.08**	**59.3**
Myriophyllum alterniflorum	5.5	4.23	3	5.5	4.23	11.9
Nitella flexilis agg.	-	-	-	5.5	5.38	18.6
Potamogeton natans	6.7	4.23	2	6.7	4.23	10.2
Sparganium angustifolium	**3.0**	**4.23**	**3**	**-**	**-**	**-**
Sphagnum (aquatic)	3.7	1.54	4	-	-	-
Utricularia minor	**4.0**	**3.08**	**1**	**4.0**	**3.08**	**5.1**
Average score	**4.8**	**3.68**		**5.3**	**4.09**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Loughnaweelagh sits within a large expanse of blanket bog on the border with the RoI. The surrounding vegetation consists predominantly of wet *C. vulgaris/Molinia* heath. A wind farm lies to the west of the lough on the RoI side. Emergent vegetation was very sparse and where present consisted of *Littorella uniflora* and *Juncus effusus*. Submerged vegetation showed typical zonation of an oligotrophic lough, although macrophyte depth was limited by the brown water. *Littorella uniflora* present up to 0.75 m depth and *Lobelia dortmana* present up to 1m depth. *Isoetes lacustris* occupying deeper water from 0.75 m up to 1.7 m depth. *Juncus bulbosus* present at all depths up to 1.4m. *Potamogeton natans* present in both sections. *Utricularia minor* only present in section 1 at depths >0.75m. *Myriophyllum alterniflorum* present

>1.4m depth. In the boat transect in section 2 *Nitella flexillis agg*. was recorded up to 2.1m depth and occupied a zone beyond *I. lacustris*.

Water quality

The water chemistry of Loughnaweelagh is typical of oligotrophic lakes, having brown, nutrient poor and base poor water (Table 18). Total phosphorus concentrations are below levels set out in the both the 2005 and 2015 CSM guidance and therefore meet 'favourable status' (JNCC 2005 & 2015). Small amount of filamentous algae were recorded (<10%) and chlorophyll a concentrations were very low throughout the year, reflecting the limited available phosphorous. Total nitrogen was also low. The lough is therefore considered to be in a 'favourable' status with respect to trophic status. The lough showed thermal stratification in June. The water was well oxygenated at the time of the survey with DO concentrations above 9 mg/l throughout the water column (Figure 7).

Table 18 Water chemistry data for Loughnaweelagh

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1988
TP	4.9	4.1	7.1	3.2	**4.82**	15
SRP	<1	<1	<1	<1	**<1**	9
TN	0.22	0.32	0.38	0.16	**0.27**	-
TON	0.008	<0.005	0.038	0.062	**<0.028**	-
Nitrite	<0.001	<0.001	<0.001	<0.001	**<0.001**	-
Chl *a*	1.54	1.21	1.32	0.29	**1.09**	1.7
DOC	3.07	6.56	6.09	3.49	**4.8**	-
pH	6.78	6.93	6.66	6.55	**6.71**	5.66
Alk	<5.00	7	<5.00	<5.00	**<5.5**	1.5
Cond	46	57	44	61	**52**	75
Ca^{2+}	<1	2.3	2.05	1.91	**<1.82**	1.3
Mg^{2+}	0.581	1.09	0.799	1.13	**0.9**	1.32
Na^{+}	3.9	6.23	5.18	7.88	**5.8**	9.5
K^{+}	0.21	0.28	0.28	0.41	**0.30**	0.32
Cl^{-}	11.3	10.5	9.5	14.8	**11.5**	18.3
SO_4^{2-}	<10	2.25	2.44	3.00	**<4.42**	5.14

Hydrology

The lough sits within a raised peat bog catchment on the NI/ROI border and is part of the Foyle catchment. There are no obvious inflows. The outflow exits the lough on the eastern side where it flows through forestry plantation and marks the border with the RoI for several miles. This tributary eventually joins the Glendergan River which itself is a tributary of the River Derg. The hydrology appeared natural.

Lake substrate

The lake basin is mixture of silt, boulders, cobbles and pebbles

Sediment load

A wind farm sits to the west of the lough. When the wind farm was constructed a considerable amount of disturbance to the peat would have been likely. Despite this no evidence of increased sediment loads was noted in Loughnaweelagh at the time of the survey.

Indicators of local distinctiveness

None noted.

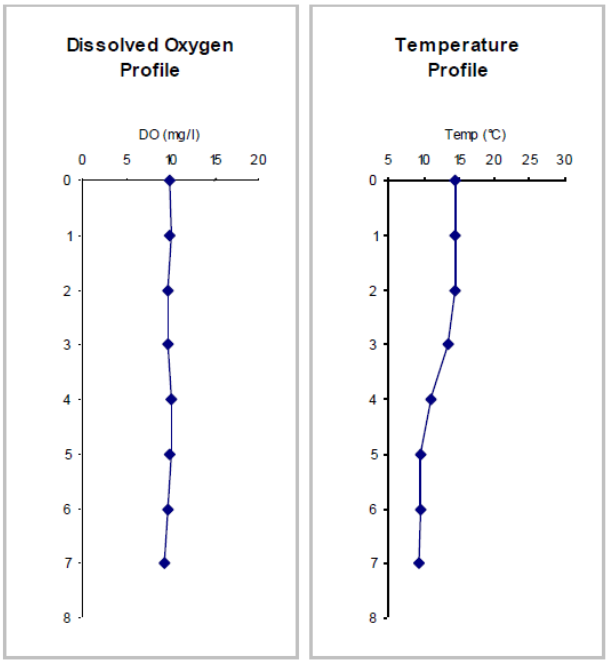
Figure 7 Dissolved oxygen and temperature profile for Loughnaweelagh (16/06/2015)

Dissolved Oxygen Profile

GPS Location	H0514383102
Maximum Depth (m)	7.5 m
Secchi Depth (cm)	310 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	9.83	14.4
1	9.83	14.4
2	9.76	14.4
3	9.63	13.6
4	10.12	11.1
5	9.92	9.7
6	9.75	9.5
7	9.25	9.4



Summary

Loughnaweelagh is an upland oligotrophic lake. It is surrounded by blanket peat bog and a nearby wind farm sits on its eastern side. The impact of wind farm appears limited as the lough meets favourable status with respect to trophic status and no other negative impacts were observed. Four characteristic species were recorded (*L. uniflora, L. dortmana*, *I. lacustris and U. minor*). The taxa present were similar to those found in the 1990 NILS survey suggesting that the site is stable. The cover of characteristic species at Loughnaweelagh is 83% which is above the CSM guideline level of 60% (JNCC 2015). The flora is present in characteristic zones (*L. uniflora* in the shallows, *L. dortmana* and *I. lacustris* in slightly deeper water with a zone of *N. flexilis agg.* beyond.

Given the characteristic water chemistry and flora this report concludes that Loughnaweelagh is in a '**favourable**' condition. However the proximity of the wind farm and nearby forestry puts loughnaweelagh '**at risk**'. Any further developments of the wind farm or expansion of the forestry into the catchment could have a negative impact on the Lough.

Table 19 Loughnaweelagh: Overview

Water Body	Status	Reason(s) for At risk	Comments
Loughnaweelagh NI Lake 231	**Favourable, at risk**	Close proximity of wind farm and forestry	Site has characteristic water chemistry and 4 characteristic species present: *L. uniflora, L. dortmana, I .lacustris* and *U. minor*.

Species list

Table 20 List of all plant species recorded at Loughnaweelagh

Marginal & Emergent species	**Abundance (DAFOR)**
Calluna vulgaris	F
Sphagnum sp.	O
Mosses unid	R
Juncus effusus	R
Potamogeton polygonifolius	R
Liverworts unid	R
Pellia epiphylla	R
Potentilla erecta	R
Viola palustris	R
Ranunculus flammula	R
Juncus squarrosus	R
Carex echinata	R
Carex nigra	R
Submerged & floating species	**% Frequency (n = 59)**
Isoetes lacustris	46
Juncus bulbosus	66
Littorella uniflora	334
Liverworts aquatic	7
Lobelia dortmana	59
Myriophyllum alterniflorum	12
Nitella flexilis agg.	19
Potamogeton natans	10
Utricularia minor	5

Survey data

Site Condition Assessment: Loughnaweelagh (16/06/2015)

Lake Details		**Survey Details**		
Lake Name	Loughnaweelagh	Survey Date	16/06/2015	
SSSI Name		Surveyors	BG & MST	
SAC Name		Shore Surveys	2	out of
Grid Ref	H052831	Wader Surveys	2	2
WBID / NI No.	50340 / 231	Boat Surveys	2	sections

Site Notes:
Majority of the lough is in the RoI. Only the western side lies in NI. without
Remote site with wind farm lying just to the west in the RoI (easiest access)

Survey Notes:
Clear water with a slightly brown tinge. Catchment afforestation. Site with very little hydrosere.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Plants to max depth of transect	
Section	**2**	Maximum depth of colonisation (cm)	210 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0518282948	H0524483028	H0521782983	H0520283036
Section	**2**	H0514483211	H0518183190	H0518683239	H0516683214

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3255	3256	3257
Section	**2**	3258	3259	3260

3.3. Mulken Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	02 August 2014
NI Lake Number:	239
WBID:	50558
County:	Tyrone
Grid reference:	H193763
OS Grid reference (X,Y):	219324,376284
Shoreline development index:	1.033
Surface area (ha.):	1.6
Maximum recorded depth (m):	4.4

Table 21 Condition Assessment Summary Table for Mulken Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed	**X**	1 characteristic species present: *S. angustifolium*
	Mesotrophic: ≥ 8 characteristic species listed	**X**	1 characteristic species present: *S. angustifolium*
	No loss of characteristic species	✓	No loss of characteristic species since the NILS survey
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	16% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	None present

Attribute	Target	Status	Comment
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	0% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Immediately around the lough the vegetation was predominantly wet *C. vulgaris* heath. This zone was enveloped by conifer plantation which surrounds the lough on all sides. On the south eastern shore the emergent vegetation was dense in places forming a hydrosere which consisted of *C. rostrata*, *H. vulgaris*, *E. fluviatile, M. trifoliata, M. scorpioides, P. australis, P. palustris, & T. latifolia*. The emergent vegetation on the north western shore was much less dense consisting only of *C. rostrata* & *E. fluviatile*, in places the shore consisted of a vertical peat cliff dropping to >0.5 m depth in the water, a 0.25 m and 0.5 m sample plot was unattainable at these locations. No submerged plants were recorded. *P. natans* was the most abundant aquatic plant growing up to 2.1 m depth. *S. angustifolium* was present upto 1m depth.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 4.4 m, Z_s = 1.38 m, Z_v = 2.1 m.
	At least the present structure should be maintained	**✓?**	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1}	**X**	TP = 33.5 µgl^{-1} (range 20-64) & TN = 0.8 mgl^{-1} (May '14 – Feb '15).
	Stable nutrients levels: TP target / limit: Mesotrophic = 15 µgl-1	**X**	
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.69 (range = 6.6 – 6.9).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X**	Waters moderately oxygenated within the top 1 m but mean DO value below thermocline = 0.83 mgl^{-1}

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of silt and peat substrates.
Sediment load	Natural sediment load maintained	✓?	The lough sits within a large tract of forestry and blanket bog. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	
	Minimal negative impacts and no fish farming	✓?	Forest operations have potential to cause negative impacts.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.6 ha, with no loss of extent of open water.

Macrophyte community composition

Mulken Lough is designated as H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*. The macrophyte taxa present, however, does not demonstrate the characteristics of this lake type. Only three floating leaved taxa were recorded (*Sparganium angustifolium, Potamogeton natans* and *Menyanthes trifoliata*). Only one of these taxa; *S. angustifolium* is characteristic for a mesotrophic lake. The marginal taxa was moderately diverse and included: *Carex rostrata, Equisetum fluviatile, Hydrocotyle vulgaris, Myosotis scorpioides, Potentilla palustris, Schoenoplectus lacustris* and *Typha latifolia*.

The NI lake survey (NILS) also recorded few aquatic taxa but only *P. natans* is common to both surveys. The NILS survey also recorded *Nuphar lutea* and *Lemna minor* which were absent from the recent survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are markedly different to those calculated form the NILS 1988 data (see Table 22). This coupled with the absence of *N. lutea* and *L. minor* suggests that the trophic status of the lake has shifted towards a nutrient poor condition.

Negative indicator species

No negative indicator species were recorded.

Macrophyte community structure

Mulken Lough sits within a catchment dominated by conifer plantations and blanket peat bog. Conifer plantations surround the lough although there is a ~10-20 m buffer between the trees and the lake shore. Although designated as a H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*, Mulken lough is perhaps closer to a H3160: Natural

dystrophic lakes and ponds. The high DOC content and absence of any submerged higher plants indicate towards this designation. However the absence of any submerged bryophytes and the high TP concentration contradicts this view. Given the lack of convincing characteristic attributes for either lake type from here on this report will treat Mulken lough as its original designation as a H3130 lake.

On the south eastern shore the emergent vegetation was dense in places forming a hydrosere which consisted of *Carex rostrata, Hydrocotyle vulgaris, Equisetum fluviatile, Menyanthes trifoliata, Myosotis scorpioides, Phragmites australis, Potentilla palustris,* & *Typha latifolia*. The emergent vegetation on the North western shore was much less dense consisting only of *C. rostrata* & *E. fluviatile*, in places the shore consisted of a vertical peat cliff dropping to >0.5 m depth in the water, a 0.25 m and 0.5 m sample plot was unattainable at these locations. No submerged plants were recorded. *P. natans* was the most abundant aquatic plant growing up to 2.1 m depth. *S. angustifolium* was present up to 1m depth.

Table 22 Aquatic macrophyte community composition for Mulken Lough, including trophic scores

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=19)***
Lemna minor	9.0	8.85	2	-	-	-
Menyanthes trifoliata	-	-	-	5.3	-	5.3
Nuphar lutea	8.5	6.92	1	-	-	-
Potamogeton natans	6.7	4.23	5	6.7	4.23	78.9
Sparganium angustifolium	**-**	**-**	**-**	**4.0**	**4.23**	**15.8**
Average score	**8.1**	**6.67**		**5.3**	**4.23**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys.

Water quality

Mulken Lough is a shallow (Zmax recorded = 4.4 m) brown water lake with an annual mean TP (33.5 µgl-1) which is well above the guideline levels for an oligotrophic lake (10 µgl-1) and mesotrophic lake (15 µgl-1) (JNCC 2015) and classifies it as "unfavourable" with respect to trophic status. The elevated TP levels are likely to be a result of forestry activities within the catchment. There are some cattle and sheep grazing but this is predominantly on rough pasture so fertiliser applications are likely to be low. DOC levels were high (14.8 mgl-1) and pH was circumneutral. Filamentous algal cover was low, as was chlorophyll a levels. The water column was moderately oxygenated (> 5 mgl-1) above 1 m depth (Figure 8) but the mean DO value below thermocline was 0.83 mgl-1, thereby reducing light penetration and thus photosynthetic activity within the water column.

Table 23 Water chemistry data for Mulken Lough

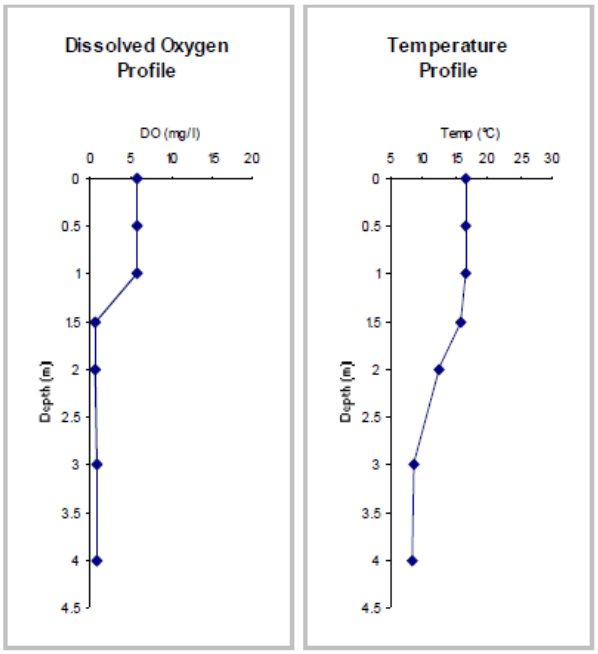
	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1988
TP	26.7	19.5	64.4	23.5	**33.5**	70
SRP	2.3	<1.0	4.1	4.1	**<3.3**	29
TN	0.61	0.6	1.2	0.78	**0.8**	1.27
TON	<0.005	<0.005	0.05	0.016	**<0.019**	-
Nitrite	0.001	<0.001	<0.001	<0.001	**<0.001**	-
Chl *a*	3.8	4.6	3.79	11.44	**5.91**	4.1
DOC	10.3	12.6	23.1	13.2	**14.8**	-
pH	6.85	6.61	6.66	6.69	**6.69**	6.32
Alk	15	32	22	15	**21**	13.6
Cond	77	106	109	123	**104**	117
Ca^{2+}	3.6	10.2	11.7	7.17	**8.17**	12.4
Mg^{2+}	1.21	2.62	2.2	2.61	**2.16**	2.7
Na^{+}	5.46	8.81	11.4	14.1	**9.94**	7.95
K^{+}	0.13	0.117	0.539	0.517	**0.33**	0.1
Cl^{-}	14.5	14.5	19.9	28.2	**19.3**	17
SO_4^{2-}	<10	3.71	8.16	5.69	**<6.89**	9.3

Figure 8 Dissolved oxygen and temperature profile for Mulken Lough (02/08/2014)

Dissolved Oxygen Profile

GPS Location H1938676279
Maximum Depth (m) 4.4 m
Secchi Depth (cm) 138 cm
Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	5.87	16.6
0.5	5.83	16.6
1	5.76	16.6
1.5	0.57	15.7
2	0.57	12.4
3	0.73	8.6
4	0.92	8.3



Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silt and sand.

Sediment load

Mulken Lough is surrounded by forestry and blanket peat bog. Forest operations, such as clearfell, within a catchment can add to the sediment load of a lake. Sediment load was high in the south eastern shore of the lough with the deep sediment making it difficult to access the water in the margins. Little evidence of recent forest operations within the immediate vicinity of the lough was apparent at the time of the survey. If large tracts of trees are felled within the lakes catchment, the sediment load would be expected to increase.

Indicators of local distinctiveness

None present.

Summary

Mulken Lough is a difficult lake to classify. It is classified as a H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* but lacks the floristic qualities characteristic of this type of lake. Only one characteristic mesotrophic species was present (*S. angustifolium*) and no submerged macrophyte taxa were present. This is perhaps caused by the very brown water, reflected in high DOC, which limits light penetration. Forestry operations within the catchment may also be adding to the sediment load which can negatively impact typical oligotrophic and mesotrophic species. However historical data from the NILS survey shows that Mulken Lough did not have any characteristic species present even then. The lake has very high TP levels, again perhaps caused by the presence of forestry within the catchment. Given the lack of characteristic flora and high TP levels, Mulken Lough is classed as **Unfavourable**.

Table 24 Mulken Lough: Overview

Water Body	Status	Reason(s) for at failure	Comments
Mulken Lough NI Lake 239	**Unfavourable**	Lack of characteristic species for either oligotrophic or mesotrophic lakes. High TP levels.	Few aquatic plants. *P. natans* the only macrophyte present in abundance.

Species list

Table 25 List of all plant species recorded at Mulken Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Caltha palustris	R
Carex rostrata	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Juncus effusus	R
Menyanthes trifoliata	R
Phragmites australis	O
Potentilla palustris	R
Ranunculus flammula	R
Sphagnum sp.	O
Typha latifolia	F
Submerged & floating species	**% Frequency (n = 19)**
Menyanthes trifoliata	5
Potamogeton natans	79
Sparganium angustifolium	16

Survey data

Site Condition Assessment: Mulken Lough (02/08/2014)

Lake Details		**Survey Details**		
Lake Name	Mulken Lough	Survey Date	02/08/2014	
SSSI Name		Surveyors	SD & EW	
SAC Name		Shore Surveys	1	out of
Grid Ref (centre)	H193763	Wader Surveys	1	1
WBID / NI No.	50558 / 239	Boat Surveys	1	sections

Site

Survey
Family of little grebe present

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	210 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H1929276313	H1938676282	H1933076339	H1933076322

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0141	0142	-

3.4. Lough Any (Peat VSh)

Annex 1 type: H3160: Natural dystrophic lakes and ponds

Survey Date	02 August 2014
NI Lake Number:	244
WBID:	50582
County:	County Tyrone
Grid reference:	H203747
OS Grid reference (X,Y):	220305,374743
Shoreline development index:	1.067
Surface area (ha.):	1.5
Maximum recorded depth (m):	1.25

Table 26 Condition Assessment Summary Table for Lough Any

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Dystrophic: Any characteristic species	✓	2 present: *Menyanthes trifoliata & Nymphaea alba*
	No loss of characteristic species	✓**?**	No previous records
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-native species recorded
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Filamentous algae present, mostly 1's. >10% cover for the whole site

Attribute	Target	Status	Comment
Macrophyte community structure	Characteristic vegetation zones should be present	✓?	*Fontinalis antipyretica* the only submerged macrophyte taxa. No vegetation zones present, but favourable for dystrophic type.
	Maximum depth distribution should be maintained	✓	Z_{max} = 1.25 m, Z_s = 0.60 m, Z_v = 1.25 m (plants to max. depth)
	At least the present structure should be maintained	✓	Hydrosere with *M. trifoliata, P. palustris, M. scorpiodes, H. vulgaris* & *C. rostrata* in the margins giving way to blanket bog with *C. vulgaris*, *Erica cinerea* & *Sphagnum spp*.. *N. lutea*, *N. alba* and *P. natans* form a broken fringe around the lough with *E. fluviatilis* growing at all depths into the middle of the lough.
Water quality	Stable nutrients levels: TP target / limit 10 μgl^{-1}	X	TP = 50.3 μgl^{-1} (range 11-97μgl^{-1}) & TN = 0.62 mgl^{-1} (May'14 – Feb'15)
	Stable pH values: pH < 5.0	X	pH = 5.62 (range = 5.21 – 7.3)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	✓	Waters were well oxygenated (>7.6 mgl^{-1}). No thermocline.
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial bloom present.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	Predominantly peat, vertical in many parts of the shore to 25-100 cm water depth
Sediment load	Natural sediment load maintained	✓?	No evidence of recent erosion, but catchment partially forested. Probable grazing although none observed.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	X?	Coniferous plantation within the catchment as well as agricultural improvement nearby.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.5 ha and with no evidence of any loss of extent of the open water. Although a local farmer did suggest that the lough was bigger in the past.

Macrophyte community composition

Lough Any is a shallow water body, with a peat dominated catchment and consequently has very brown water which limits light penetration. *Fontinalis antipyretica* was the only recorded submerged macrophyte. The floating leaved taxa: *Nuphar lutea*, *Nymphaea alba* and *Potamogeton natans* occurred in a broken fringe around the lough. *Equisetum fluviatile* grew at all depths throughout the lough although it was more abundant towards the shore. A hydrosere comprising of predominantly *Hydrocotyle vulgaris, Menyanthes trifoliata, Potentilla palustris* occurred sporadically in the margins, other areas were devoid of a hydrosere and consisted of bare peat. No oligotrophic or mesotrophic characteristic species were present, and the lough is considered most typical of the natural dystrophic lakes and ponds habitat type. Two dystrophic species were recorded and given the nature of the site this would seem a more appropriate classification.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 7.1 and 5.7 respectively (Table 2). These values are a notable increase from the same scores calculated from 1990 survey data, suggesting that a trophic shift has occurred to more eutrophic conditions. The plant taxa list does not support this though as the dominant taxa are still similar to what was observed in 1990. The varying methodologies between the 1990 survey and the 2014 survey may account for the differences in this instance.

Table 27 Aquatic macrophyte community composition for Lough Any, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=62)***
Fontinalis antipyretica	6.3	5.38	**2**	6.3	5.38	56
Lemna minor	9.0	8.85		9	8.85	8
Liverworts aquatic	-	-	1	-	-	-
Menyanthes trifoliata	**5.3**	**-**	-	**5.3**	**-**	**4**
Nuphar lutea	8.5	6.92	1	8.5	6.92	8
Nymphaea alba	**6.7**	**3.08**	2	**6.7**	**3.08**	**8**
Potamogeton natans	6.7	4.23	5	6.7	4.23	40
***Sphagnum* sp.**	**3.7**	**1.54**	**2**	**-**	**-**	**-**
Average score	**6.6**	**4.23**		**7.1**	**5.70**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

No alien species were recorded from the site and no negative indicator species and only small amounts of filamentous algal occurred within the lough.

Macrophyte community structure

Lough Any has brown waters and being shallow is unlikely to exhibit the characteristic zonation seen in deeper, clear water sites, however, zonation does occur to some extent. In places a marginal hydrosere is replaced with a fringe of floating leaved taxa which is in turn replaced with a zone of submerged *F. antipyretica* as the lough gets slightly deeper. The current structure is considered favourable.

Water quality

Table 28 Water chemistry data for Lough Any

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1990
TP	96.6	10.5	68.6	25.8	**50.4**	33
SRP	34.8	<1.0	45.1	7.0	**<22.0**	8
TN	0.68	0.68	0.73	0.4	**0.62**	0.63
TON	<0.005	0.013	0.043	0.013	**<0.019**	-
Nitrite	0.002	<0.001	<0.001	<0.001	**<0.001**	-
Chl a	14.08	0.47	1.61	0.60	**4.19**	1.7
DOC	8	11.3	11.8	4.52	**8.91**	-
pH	6.75	7.3	5.5	5.21	**5.62**	6.03
Alk	6	37	6	<5.00	**<13.5**	6.1
Cond	31	108	31	82	**63**	76
Ca2+	2.48	8.74	1.27	1.72	**3.55**	2.44
Mg2+	1.02	2.21	0.54	1.47	**1.31**	1.34
Na+	9.17	9.75	9.41	11.5	**9.96**	8.86
K+	0.79	0.45	1.00	0.71	**0.74**	0.26
Cl-	6.7	14	6.8	22.5	**12.5**	15.48
SO42-	<10	2.49	1.43	3.31	**<4.31**	4.23

Although classified as an oligotrophic to mesotrophic lake, in this report Lough Any is considered to be closer to the Dystrophic type, despite not showing clear characteristics of either of the lake types. The water chemistry of Lough Any is suggestive of a dystrophic lake, having a relatively low pH (although slightly above CSM guideline levels), and high dissolved organic carbon (DOC). The high levels of DOC suggest the majority of the acidity is derived from humic acids (from the peat) rather than mineral acidity or from anthropogenic sources (acid deposition). Total phosphorus is above the level set in the CSM guidelines for a dystrophic lough (JNCC 2015), but it is recognised that the interaction of nutrients in high DOC sites is complex and therefore elevated TP is not always indicative of unfavourable conditions.

Unlike other lake type's phosphorus is often not the limiting plant nutrient in dystrophic systems; however TN doesn't appear to be a limiting nutrient either in Lough Any. The floating leaved taxa are common in Lough Any, which is uncommon in true dystrophic lakes, suggesting that lack of nutrients may not be the limiting

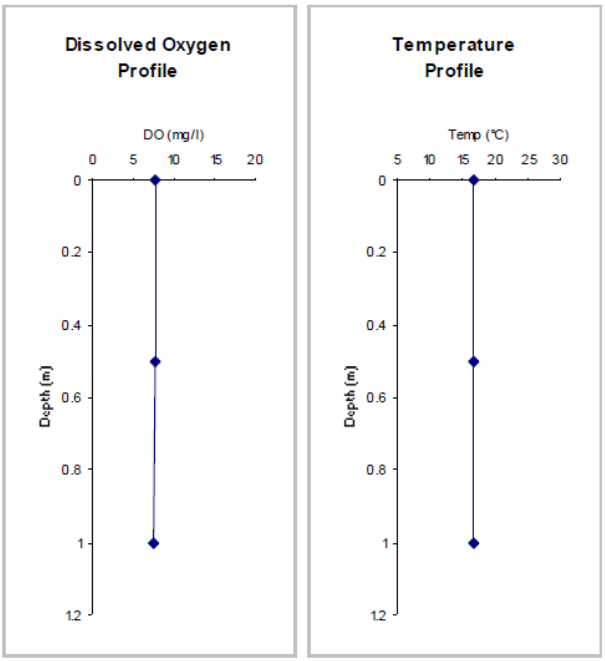
factor. The brown water also reduces light penetration through the water column and thus suppresses algal growth as well as limiting the growth of higher aquatic plants. There is limited evidence of the effects of nutrient enrichment at the site, although filamentous algae was present in some survey plots but not at high levels and therefore Lough Any is considered to be in “favourable condition” with respect to trophic status. Other water quality parameters are consistent with the lake type (i.e. dystrophic, LA Sh). The lake was well oxygenated (DO at 1 m water depth was 7.6 mgl^{-1}).

Figure 9 Dissolved oxygen and temperature profile for Lough Any (02/08/2014)

Dissolved Oxygen Profile

GPS Location	H2035374746
Maximum Depth (m)	1.25 m
Secchi Depth (cm)	60 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	7.72	16.7
0.5	7.71	16.7
1	7.6	16.7



Hydrology

There are no discernible outflow or inflow streams, also confirmed by the local farmer. The hydrological regime at the site is natural.

Lake substrate

The lake margins are predominantly vegetated peat, and the open water substrate consisted of organic sediments.

Sediment load

All the land immediately surrounding Lough Any is largely undisturbed *Calluna* dominated heathland bog. There is no evidence of increased sediment loads from these areas. Coniferous plantation (Carrickaholten Forest) surrounds the lough but at some distance (>50m from the shore), so it is unclear how much impact this has on the lough. There is currently no evidence of increased sediment loads from the afforested areas, but it is likely that disturbance was caused during planting and further risk would occur if the area is felled.

Indicators of local distinctiveness

None specified.

Summary

Lough Any is surrounded by *Calluna* heath and raised bog and it drains from a peat catchment and hence has high DOC levels and an acid pH. Despite being classified as oligotrophic to mesotrophic this report concludes that the site is more typical of a Dystrophic type lake. Two characteristic dystrophic species occur although an absence of any submerged bryophytes or liverworts other than *F. antipyretica* is atypical for this lake type. TP levels are high for this type of lake and are above guideline levels. Forestry and agricultural improvement occurs within the vicinity of the lake it is unclear if these activities are the cause of the high TP. Despite the high levels there appears to be little evidence of impact with respect to the phytoplankton and filamentous algae. Macrophyte growth is however perhaps more abundant than is typical for a dystrophic lake with large patches of *N. lutea, P. natans* and *N. alba*. The macrophyte taxa list appears little changed since the survey in the 1980's, although the absence of submerged sphagnum is notable.

Lough Any is a difficult lake to classify. The classification that best fits is dystrophic but the lake is not a good example of this lake type. However the lake does not appear to have changed significantly since the last survey in the 1980s and land use immediately around the lake is looks unchanged since that time with a good example of raised bog enveloping the lake. Of concern is the TP levels therefore the lake is classed as **Favourable, at risk.** Any changes in forestry and/or improvements of the raised bog for agriculture or peat cutting could impact the ecology of the lake and thus status.

Table 29 Lough Any: Overview

Water Body	Status	Reason(s) for concern	Comments
Lough Any NI Lake 244	**Favourable, at risk.**	High TP values	Stable dystrophic lough with 2 characteristic species. High TP levels of concern.

Species list

Table 30 List of all plant species recorded at Lough Any in 2014

Marginal & Emergent species	**Abundance (DAFOR)**
Juncus effusus	O
Myosotis scorpioides	O
Equisetum fluviatile	O
Sphagnum sp.	O
Carex sp.	O
Calluna vulgaris	O
Potentilla palustris	O
Carex rostrata	R
Hydrocotyle vulgaris	R
Caltha palustris	R
Cardamine pratensis	R
Menyanthes trifoliata	R
Succisa pratensis	R
Erica cinerea	R
Galium palustre	R
Polytrichum commune	R
Juncus acutiflorus	R
Phragmites australis	R
Submerged & floating species	**% Frequency (n = 33)**
Fontinalis antipyretica	3
Lemna minor	37
Menyanthes trifoliata	68
Nuphar lutea	+
Nymphaea alba	2
Potamogeton natans	32

Survey data

Site Condition Assessment: Lough Any (02/08/2014)

Lake Details		**Survey Details**	
Lake Name	Lough Any	Survey Date	02/08/2014
SSSI Name		Surveyors	SD & EW
SAC Name		Shore Surveys	1 out of
Grid Ref (centre)	H203747	Wader Surveys	1 1
WBID / NI No.	50582 / 244	Boat Surveys	1 sections

Site Notes:
Very shallow, small peaty lough surrounded by raised bog and forestry.

Survey Notes:
Gate at road padlocked, requires farmers assistance. Spoke with farmer. He can remember fishing on the lough and occasionally harvests bog bean for medicinal purposes.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	125 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	0.5 m
	Notes: No Compass	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H2029874716	H2039174738	H2034374698	H2035274724

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0138	0139	-

3.5. Keenaghan Lough (MA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	27 August 2014
NI Lake Number:	627
WBID:	50086
County:	Fermanagh
Grid reference:	G975599
OS Grid reference (X,Y):	197466,359880
Shoreline development index:	1.692
Surface area (ha.):	18.8
Maximum recorded depth (m):	2.7

Table 31 Condition Assessment Summary Table for Keenaghan Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species	**X**	1 present: *Sparganium angustifolium.* No *Littorella uniflora, Isoetes* spp. or *Lobelia dortmanna*
	Mesotrophic: ≥ 8 characteristic species listed	**X**	2 Broadleaf *Potamogeton* spp. (*P. gramineus* and *P. perfoliatus*) and *S. angustifolium*
	No loss of characteristic species	**X**	*Littorella uniflora* and *Nitella flexilis* recorded in 1990, but not in 2014.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	Only 21% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 1% frequency. Zebra mussels observed throughout lough.
	Filamentous Algae (non-*Chara):* <20% of points scoring '3'	✓	Only 7% of sampling points scored a cover of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Good marginal vegetation dominated by rushes and herbs: *C. palustris, J. acutifloris, J. effusus, J. inflexus, P. anserina, F. ulmaria* and *H. vulgaris* most abundant species. Wet woodland on the south shore. Margins with emergent species are patchy, mostly in S1 on the southern shore, dominated by *P. australis, S. lacustris* and *C. rostrata. N. lutea* recorded in shallow depths (25->75 cm) in S2, S3, & S4. *Chara virgata* found occasionally in all sections (25 – 140 cm). *P. lucens* frequent throughout lough (25 – 200 cm), while *P. gramineus* only in S1 (25 – 50 cm), *P. berchtoldii* only in S2 at 50 cm and *P. perfoliatus* only in S4 at >75 cm. *S. angustifolium* recorded occasionally in S2, S3 & S4 (25-180 cm). *M. alterniflorum* sporadically recorded S2 & S4 in shallow waters (25-50 cm). *F. antipyretica* frequent in all sections, 25 – 240 cm. *E. canadensis* recorded with minimal occurrence in S4 at 50 cm. Some degree of zonation observed.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 2.7 m, Z_s = 2.1 m (1.23 m in turbid survey sections), Z_v = 2.4 m
	At least the present structure should be maintained	✓**?**	No evidence of change, although limited information from 1990 survey
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 20 μgl^{-1}	✓	TP = 17.7 μgl^{-1} (range 12.7 – 26.7) & TN = 0.86 mgl^{-1} (April '14 – Feb. '15). Favourable for Mesotrophic.

Attribute	Target	Status	Comment
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.8 (range = 7.6 – 8.0). Favourable for mesotrophic only
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	✓	Waters were well mixed and oxygenated throughout the water column: mean DO of 8.96 7mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	**X**	Natural shoreline for most part maintained, but concrete revetments installed in S3 and a series of jetties, with concrete revetment along much of the north shore (S4). Riparian macrophyte cutting observed in S1, S3 & S4.
	Natural and characteristic substrate maintained	**X**	Margins with concrete revetments extending to >75 cm depth in S3 and S4. Boulders and pebbles with silty substrate in open waters. Sands in deeper waters on southeast side of lough.
Sediment load	Natural sediment load maintained	✓	Grazing in catchment, but impact considered negligible. Poaching observed at time of survey, no evidence for increased sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	✓**?**	None specified.
	Minimal negative impacts and no fish farming	**X**	Shore and boat angling at site. Concrete revetments on north side of lough. Macrophyte riparian cutting on south and north shores. Zebra mussels observed throughout lough.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 18.8 ha and there is no evidence of any loss of extent of the open water.

Macrophyte community composition

Only one characteristic oligotrophic species, *Sparganium angustifolium,* was recorded in Keenaghan Lough, with a frequency of 12% across boat and wader transects. There was a noticeable absence of any other *Littorelletea* flora, including *Littorella uniflora,* which was recorded in 1990 with an abundance of 2 (on a 1-5 scale), which suggests that its growth extent within the lough may have reduced. Only two broad-leaved *Potamogeton* species were present, which are characteristic of mesotrophic waters. Considering the low number of characteristic species

recorded, only 21% of vegetated sample spots comprised of mesotrophic species. Therefore the macrophyte assemblage was not consistent with that expected for "oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*" and is considered unfavourable within the guidelines as defined in the CSM (JNCC 2015). The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 7.2 and 6.47 respectively (Table 32), which are slightly lower than the TRS and PLEX scores calculated from the 1990 species assemblage of 7.8 and 6.48, suggesting a slight improvement in trophic status.

Table 32 Aquatic macrophyte community composition for Keenaghan Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=96)***
Chara spp.	8.5	7.69	2	-	-	-
Chara aspera	8.5	7.69	+	-	-	-
Chara virgata	-	-	-	8.5	7.69	8
Elodea canadensis	8.5	7.95	3	8.5	7.95	1
Fontinalis antipyretica	6.3	5.38	3	6.3	5.38	44
Lemna minor	9.0	8.85	1	-	-	-
Lemna trisulca	10.0	8.85	3	-	-	-
Littorella uniflora	**6.7**	**4.23**	**2**	**-**	**-**	**-**
Myriophyllum alterniflorum	5.5	4.23	1	5.5	4.23	5
Nitella flexilis	**5.5**	**5.38**	**+**	**-**	**-**	**-**
Nuphar lutea	8.5	6.92	2	8.5	6.92	16
Nymphaea alba	6.7	3.08	1	-	-	-
Potamogeton berchtoldii	-	-	-	7.3	7.69	1
Potamogeton gramineus	**7.3**	**7.31**	**2**	**7.3**	**7.31**	**3**
Potamogeton lucens	10.0	7.88	3	10.0	7.88	47
Potamogeton natans	6.7	4.23	2	6.7	4.23	+
Potamogeton perfoliatus	**-**	**-**	**-**	**7.3**	**7.69**	**1**
Sparganium angustifolium	**-**	**-**	**-**	**3.0**	**4.23**	**18**
Sparganium emersum	10.0	7.5	2	-	-	-
Average score	**7.8**	**6.48**		**7.2**	**6.47**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. *A plus (+) denotes taxa recorded as present at the site but not found growing in the survey sections

Negative indicator species

Elodea canadensis was present at only 1% of the sample plots. Any persistent presence of this species is considered to be unfavourable according to the CSM

guidelines (JNCC, 2015). It was recorded as frequent ('3' on a scale of 1-5) in 1990, though it must be noted that the survey data from 1990 and 2014 were recorded differently. Low levels of filamentous algae were recorded, with only 7% of sampling points scoring a cover of '3'. Zebra mussels were noted to be present throughout the lough, implicating the site as unfavourable with respect to negative indicator species.

Macrophyte community structure

The dominant land cover was rough pasture with tall herbs along the margins of the lough. The most abundant species included *Caltha palustris, Juncus acutifloris, Juncus effusus, Juncus inflexus, Potentilla anserine, Filipendula ulmaria* and *Hydrocotyle vulgaris.* Wet woodland borders the southern shore, with *Alnus glutinosa* as the dominating tree. Margins with emergent species are patchy, occurring mostly on S1 on the southern shore, where *Phragmites australis, Schoenoplectus lacustris* and *Carex rostrata* had colonised. *Nuphar lutea* was recorded sporadically in shallow depths (25 - >75 cm) in S2, S3 and S4. Submerged aquatic flora include *Chara virgata,* which was found occasionally in all sections in depths between 25 – 140 cm. *Potamogeton lucens* was recorded as frequent throughout the lough (25 – 200 cm) while *Potamogeton gramineus* was only found in S1 between 25 – 50 cm. *Potamogeton berchtoldii* was only recorded in S2 in one spot, at 50 cm depth. Similarly *Potamogeton perfoliatus* was observed only in S4 at >75 cm. *Sparganium angustifolium* was recorded occasionally in sections 2, 3 and 4 at a range of depths between 25 – 180 cm. *Myriophyllum alterniflorum* was sporadically recorded in S2 and S4 in shallower waters of 25 – 50 cm. *Fontinalis antipyretica* was frequently recorded in all sections, at a wide range of depths (25 – 240 cm). In 1990, *Elodea canadensis* posed no threat to the macrophyte community, appearing just once within the confines of the survey close to the northern shore at 50 cm depth. Some degree of zonation was observed, although zonation of the *Littorelletea* flora was absent.

Water quality

The water chemistry of Keenaghan Lough is typical for a moderate alkalinity shallow lake, with a circumneutral pH. Annual mean total phosphorus is within the target level set in the CSM guidelines for a very shallow, mesotrophic lake (20 μgl^{-1} JNCC 2015), although TP concentrations fluctuate seasonally and exceeds the target level in early winter (November). Total phosphorus is also significantly lower than the concentration measured from a spot water sample taken in summer 1990, although direct comparisons should be treated with caution as only one sample was taken in 1990 and was not following CSM methodologies. Despite the turbid, brown water of the lough, Chl *a* levels appear to be low throughout the year and on average slightly lower than the measured 1990 spot water sample. It appears that the lough has seen a slight improvement in trophic status over the past 24 years. Low levels of filamentous algae were recorded and the lough shows no other signs of nutrient enrichment (such as excessive growth of *Juncus bulbosus*). Waters were well mixed and oxygenated throughout the water column, with a mean dissolved oxygen reading of 8.96 7mgl^{-1}.

Hydrology

Keenaghan Lough lies within close proximity to Lower Lough Erne, with an outflow stream to the west of the lough connecting it to the River Erne. The hydrological regime at the site appears natural.

Table 33 Water chemistry data for Keenaghan Lough

	Apr '14	Aug. '14	Nov. '14	Feb. '15	Mean	1990
TP	14.8	16.5	26.7	12.7	**17.68**	23
SRP	0.003	0.001	0.003	0.002	**0.002**	11
TN	0.59	0.67	1.24	0.94	**0.86**	2.65
TON	0.069	0.065	0.217	0.412	**0.191**	-
Nitrite	0.002	0.001	0.002	0.002	**0.002**	-
Chl *a*	3.96	1.1	1.43	0.33	**1.705**	2.56
DOC	9.3	10.5	14.5	7.97	**10.57**	-
pH	7.87	7.96	7.55	7.8	**7.77**	8.01
Alk	95	89	88	70	**85.50**	47.9
Cond	241	221	223	237	**230.50**	277
Ca^{2+}	36.6	33.6	33.1	28.4	**32.93**	38.7
Mg^{2+}	3.48	3.36	3.63	3.31	**3.45**	4.2
Na^{+}	11.4	10.9	10.8	15.4	**12.13**	7.25
K^{+}	1.05	0.878	1.41	1.37	**1.18**	0.45
Cl^{-}	21.6	19	19.2	30.6	**22.60**	35.6
SO_4^{2-}	<10	5.86	10.1	7.91	**8.47**	11.34

Figure 10 Dissolved oxygen and temperature profile for Keenaghan Lough (21/08/2014)

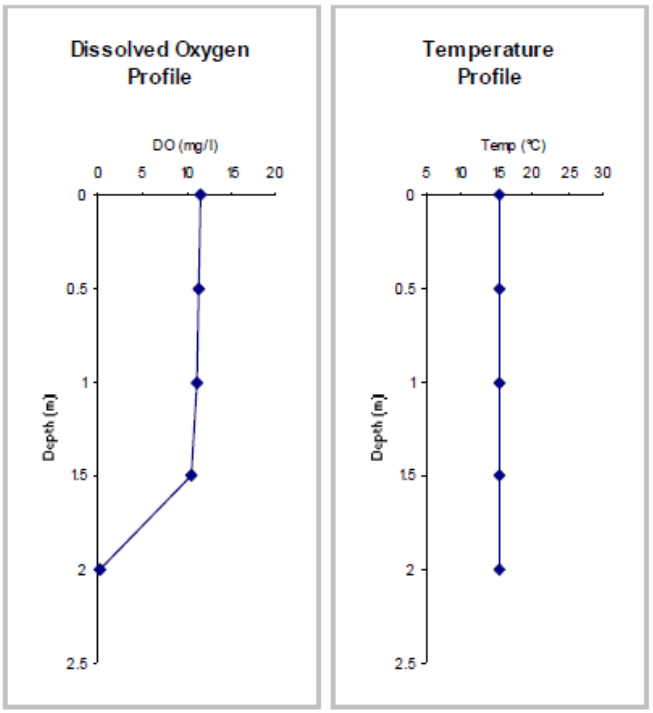
Site Condition Assesment: Keenaghan Lough (21/08/2014)

Dissolved Oxygen Profile

GPS Location	G9756859867
Maximum Depth (m)	2.1 m
Secchi Depth (cm)	1.23 cm

Notes: Some 2.4m depths and one 2.9m depth but boat kept dragging in strong wind

Depth (m)	DO (mg/l)	Temp (°C)
0	11.5	15.2
0.5	11.4	15.2
1	11.1	15.2
1.5	10.5	15.2
2	0.3	15.3



Lake substrate

The marginal lake substrates were predominantly boulders and pebbles, with silty substrates in the open water. Sands were observed in deeper waters on the southeast side of the lough. Within S3 and S4, the margins comprised of concrete revetments extending to >75 cm depth and a series of jetties along the north shore. Riparian macrophyte cutting was observed in S1, S3 and S4.

Sediment load

Grazing in the catchment was observed at the time of survey, but the impact is considered to be negligible. Poaching was also noted, but there was no evidence for an increased sediment load as a result. Keenaghan Lough is a fishing lake which is stocked with trout. Turbid, brown waters were observed, which could be attributed to this activity.

Indicators of local distinctiveness

None specified.

Summary

Keenaghan Lough is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”, but fails to achieve the necessary floristic requirement as defined within the CSM guidance (JNCC 2015). Only one oligotrophic species was present, *Sparganium angustifolium*, with relatively low frequency. *Littorella uniflora* was recorded in 1990 with occasional abundance (‘2’ on a 1-5 scale) and so it is possible that it is either absent or at very low frequency in the lough to not be observed in the 2014 survey. Turbid, brown waters were prominent in summer 2014, which could be attributed to

the regular stocking of trout, since Keenaghan Lough is used as a fishing lake. This has ultimately affected light penetration, with Z_s dropping to 1.23 m within the macrophyte zone of growth. This would explain the general lack or low frequency of *Littorelletea* flora and broad-leaved *Potamogeton* species within the lough. Concrete revetments along the shoreline further prevent macrophyte growth. The water chemistry is typical for mesotrophic waters, having circumneutral pH, and TP and Chl *a* concentrations appear to be lower than in 1990, and the lough shows no other effects of nutrient enrichment, except for moderate levels of filamentous algea (e.g. excessive growth of *Juncus bulbosus*). With no evidence of recent algal turbidity and relatively low TP, the current water quality is considered favourable for mesotrophic status. The aquatic macrophyte flora is more indicative of eutrophic conditions and therefore the lough is classified as **unfavourable** for its designated type. There was no evidence of recent erosion or increased sediment loads to the lough, despite the in the catchment being predominantly agricultural. There were litter problems noted at the site, and the lough is used for boat and shore angling.

Table 34 Keenaghan Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Keenaghan Lough NI Lake 627	**Unfavourable**	Only 1 characteristic oligotrophic spp. and 2 broad-leaved *Potamogeton* spp. at low frequency. Zebra mussels observed in lough.	Water quality is favourable, but flora does not comply with characteristic mesotrophic species. Water brown and turbid – further investigation required.

Species list

Table 35 List of all plant species recorded at Keenaghan Lough

Marginal & Emergent species	Abundance (DAFOR)
Achillea millefolium	R
Alisma plantago-aquatica	R
Alnus glutinosa	O
Angelica sylvestris	R
Apium nodiflorum	R
Caltha palustris	O
Carex nigra	R
Carex rostrata	R
Cerastium fontanum	R
Eleocharis palustris	R
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum palustre	R
Filipendula ulmaria	O
Galium palustre	R
Hydrocotyle vulgaris	R
Hypericum tetrapterum	R
Iris pseudacorus	R
Juncus acutiflorus	F
Juncus effusus	F
Juncus inflexus	R
Lychnis flos-cuculi	R
Lysimachia nummularia	R
Mentha sp.	O
Myosotis scorpioides	R
Persicaria hydropiper	R
Potentilla anserina	O
Ranunculus flammula	R
Salix sp.	R
Senecio aquaticus	R
Stellaria palustris	R

Submerged & floating species	% Frequency (n = 96)
Chara virgata	8
Elodea canadensis	1
Fontinalis antipyretica	44
Myriophyllum alterniflorum	5
Nuphar lutea	16
Potamogeton berchtoldii	1
Potamogeton gramineus	**3**
Potamogeton lucens	47
Potamogeton natans	+
Potamogeton perfoliatus	**1**
Sparganium angustifolium	**18**

Survey data

Site Condition Assessment: Keenaghan Lough (21/08/2014)

Lake Details		**Survey Details**		
Lake Name	Keenaghan Lough	Survey Date	21/08/2014	
SSSI Name		Surveyors	SG, HG	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	G975599	Wader Surveys	4	4
WBID / NI No.	50086 / 627	Boat Surveys	3	sections

Site Notes:

Survey Notes:
Zebra mussels at S3, P3 across all depths. S4, P1: substrate all concrete.
Zebra mussels at S4, P3, P4

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	190 cm
		Compass bearing of boat transect (°)	150 °
		Lateral distance from waters edge to 75cm depth (m)	-
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	240 cm
		Compass bearing of boat transect (°)	134 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes: Zebra mussel on boat transect @ 70cm	
Section	**3**	Maximum depth of colonisation (cm)	220 cm
		Compass bearing of boat transect (°)	154 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Possibly a lake that has become more eutrophic	
Section	**4**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	4 m
		Notes: No boat survey done due to very high winds	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	G9739659710	G9729359701	G9734259700	G9733759725
Section	**2**	G9770959855	G9780059904	G9775459882	G9772759913
Section	**3**	G9761059756	G9751459733	G9756059743	G9754459765
Section	**4**	G9771059981	G9759059997	-	-

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	221	224/222	223
Section	**2**	225	226,227	228
Section	**3**	229	230	231
Section	**4**	0240	0242	-

3.6. Lough Achork 630 (LA, VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	29 June 2014
NI Lake Number:	630
WBID:	50327
County:	Fermanagh
Grid reference:	H041555
OS Grid reference (X,Y):	204142,355469
Shoreline development index:	1.462
Surface area (ha.):	3.6
Maximum recorded depth (m):	5.2

Table 36 Condition Assessment Summary Table for Lough Achork

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	**X**	1 present: *Sparganium angustifolium.*
	Mesotrophic: ≥ 8 Characteristic species present	**X**	2 present: *Potamogeton alpinus & Sparganium angustifolium*. Also *Potamogeton natans*.
	No loss of characteristic species	**X?**	*Nitella sp*. present in 1988 survey. No other recent survey to make comparison

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	37% of vegetated sample spots comply for oligotrophic species and 40% for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Some filamentous algae recorded >10%, mostly 1's.
Macrophyte community structure	Characteristic vegetation zones should be present	✓**?**	The eastern and western ends of the lake are bordered by *Phragmites australis*, *Carex rostrata (*0.25-0.5m*)* and *Schoenoplectus lacustris* (0.25-0.75m). Northern and southern shores with less emergent vegetation but *Carex rostrata* common as well as *Fontinalis antipyretica* . *Potamogeton alpinus* abundant at 0.5m at western end. *Potamogeton natans* scattered throughout the site (0.5-0.75m)
	Maximum depth distribution should be maintained	✓	Z_{max} = 5.2 m, Z_s = 0.47 m, Z_v = 1.3 m.
	At least the present structure should be maintained	✓	Baseline survey.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	**X**	TP = 42 μgl^{-1} (range 22-63) & TN = 0.82 mgl^{-1} (April '14 – Feb '15). Unfavourable for oligotrophic and mesotrophic waters.
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.84 (range = 6.6 – 7.2).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X**	Mean DO below the thermocline (0.45 mgl^{-1})
	No excessive growth of cyanobacteria or green algae	✓	None recorded
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural, although a footpath has been constructed around the lake but this is mostly away from the lake shore
	Natural and characteristic substrate maintained	**X**	Silty substrate throughout with a few boulders. Silt over hard substrate suggests excessive siltation for this type of lake.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	**X?**	Catchment is heavily forested with recent deforestation which has probably added to the sediment load
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	**X?**	The lake is a public fishery and is stocked .

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 3.6 ha with no loss of extent to the open water.

Macrophyte community composition

Lough Achork lies within a predominantly peat catchment which has been heavily forested with conifer trees. No isoetid species were recorded, and the lough has only one characteristic oligotrophic species (*Sparganium angustifolium*). In terms of mesotrophic species, only one characteristic broadleaf *Potamogeton* spp. was recorded (*Potamogeton alpinus*). 40% of vegetated sample spots had ≥ 1 characteristic mesotrophic species therefore not achieving favourable condition target for characteristic species abundance. Other submerged and floating-leaved aquatic macrophyte taxa growing in the lough were *Fontinalis antipyretica*, *Nuphar lutea, Chara virgata, Potamogeton obtusifolius* and *P. natans.* Marginal emergent vegetation occurred mostly in the eastern and western end of the lough, comprising *Schoenoplectus lacustris, Carex rostrata, Phragmites australis, Eleocharis palustris, Juncus acutifloris and Equisetum fluviatile*.

Species recorded in 1988 but absent from the 2014 survey were *Callitriche hamulata, Myriophyllum alterniflorum, Lemna minor* and *Nitella flexilis var. flexilis*. Species recorded in 2014 but not in 1988 were *Potamogeton obtusifolius*. Despite the variation in survey methods between 1988 and 2014 surveys the species composition remains broadly similar The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site (Table 37) are comparable to those calculated from the 1988 survey suggesting minimal change in trophic status in that time (Table 37).

Negative indicator species

No alien or nuisance species were recorded from the site. This is a popular angling spot so good biosecurity should be encouraged to maintain the absence of invasive species.

Macrophyte community structure

The eastern and westerns shores of the lough are fringed with fen vegetation comprising; *Carex rostrata*, *P. australis and S. lacustris* with *N. lutea* growing within the matrix. At the western end the substrate is deep silt whereas at the eastern shore the substrate is predominantly sand. *P. alpinus, S. angustifolium* occurs beyond the marginal fringe (0.4-0.9m). Along the northern and southern shore the emergent

vegetation is sporadic mainly comprising *C. rostrata* and *E. fluviatile* with *F. antipyretica* growing in the shallows and up to 1.3m depth.

The water was very dark brown (Z_s = 0.47 m) which will limit plant growth at depth. The only submerged plant found at a depth >0.75m was *F. antipyretica*, which was found at depths of up to 1.3m. No plant survey was performed at section 3 as no submerged plants were found beyond 0.75m. The lough appears to have lost three submerged species since 1988 (*C. hamulata, M. alterniflorum* and *Nitella flexilis var. flexilis*). These species are often associated with slightly deeper water than the current assemblage which suggests the maximum depth of colonisation may have been compromised by an increase in water colour. A better understanding of the site history is required to establish if forestry (or other factors) have negatively influenced the water clarity at the site to the detriment of the community structure.

Table 37 Aquatic macrophyte community composition for Lough Achork, including trophic scores

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=38)***
Callitriche hamulata	5.0	6.15	2	-	-	-
Charophytes	8.5	7.69	1	-	-	-
Chara virgata	-	-	-	8.5	7.69	+
Fontinalis antipyretica	6.3	5.38	4	6.3	5.38	41.8
Lemna minor	9.0	8.85	1	-	-	-
Myriophyllum alterniflorum	5.5	4.23	2	-	-	-
Nitella flexilis flexilis	5.5	5.38	+	-	-	-
Potamogeton alpinus	**5.5**	**5.38**	**4**	**5.5**	**5.38**	**11.9**
Potamogeton natans	6.7	4.23	3	6.7	4.23	4.5
Potamogeton obtusifolius	-	-	-	7.3	6.54	3
Nuphar lutea	8.5	5.38	2	8.5	5.38	20.9
Sparganium angustifolium	**3.0**	**4.23**	**3**	**3.0**	**4.23**	**37.3**
Average score	**6.4**	**5.38**		**6.5**	**5.19**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys A plaus (+) denotes a species outside the survey sections and seen growing in the lough or present in the strandline

Water quality

The water chemistry of Lough Achork (Table 38 Water chemistry data for Lough AchorkTable 38) is atypical for an oligotrophic to mesotrophic lough, having high TP levels (mean 42 µg/l) and TN levels (mean 0.82 mgl^{-1}). The site has very brown water which is reflected by the high DOC levels (mean: 22.03 mgl^{-1}) and therefore the lake shares many common features with dystrophic lake types. Light penetration is very low (Secchi depth = 0.47 m), and the aquatic flora is probably limited more by

light availability that water quality and the likelihood that the site could support a typical oligo / mesotrophic flora is therefore unlikely.

TP levels are however above the target level set in the CSM guidelines for both oligotrophic (10 μgl^{-1}) and deeper mesotrophic waters (15 μgl^{-1} JNCC 2015).Given the extensive forestry operations in the catchment this is perhaps unsurprising. It has been shown that the presence of coniferous forest within the catchment of a peatland lake can cause phosphorous release to freshwater, especially after felling operations (Drinan *et al*. 2013). Chlorophyll a levels are also relatively low which given the high TP levels is surprising, but phytoplantkton growth is probably also suppressed by the dark brown water reducing light penetration. Other water quality parameters are consistent with the lake type (i.e. oligotrophic, LA Sh). At the time of survey oxygen concentrations below the thermocline were low (mean DO 0.45 mgl^{-1}).

Table 38 Water chemistry data for Lough Achork

	Apr '14	Aug '14	Nov '15	Feb'15	Mean	1988
TP	32.2	63.4	51.6	22.4	42.0	33
SRP	11.7	26.0	21.9	10.1	17.4	20
TN	0.68	1.11	1.04	0.46	0.82	0.87
TON	0.019	0.043	0.121	0.089	0.068	-
Nitrite	0.005	0.003	<0.001	<0.001	<0.0024	-
Chl *a*	7.48	6.16	0.96	0.55	3.79	14.1
DOC	18.6	32.3	26.6	10.6	22.03	-
pH	7.27	6.87	6.63	6.8	6.84	6.7
Alk	25	22	24	9	20	12
Cond	95	90	91	118	98.5	156
Ca^{2+}	7.22	8.96	8.26	6.34	7.7	14.1
Mg^{2+}	2.19	2.35	2.18	2.42	2.29	3.3
Na^{+}	9.86	9.31	9.89	13.6	10.67	12.7
K^{+}	0.682	0.843	0.829	0.811	0.79	0.07
Cl^{-}	17.6	15.5	17.8	29.4	20.1	27.5
SO_4^{2-}	<10	3.69	4.97	5.23	<5.97	11.4

Hydrology

Lough Achork is close to the source of the River Sillees which joins the River Erne near Enniskillen. A small inflow stream flows into the lough on the eastern end of the lough with. The outflow is at the western end which is heavily silted. The hydrological regime at the site appears natural.

Lake substrate

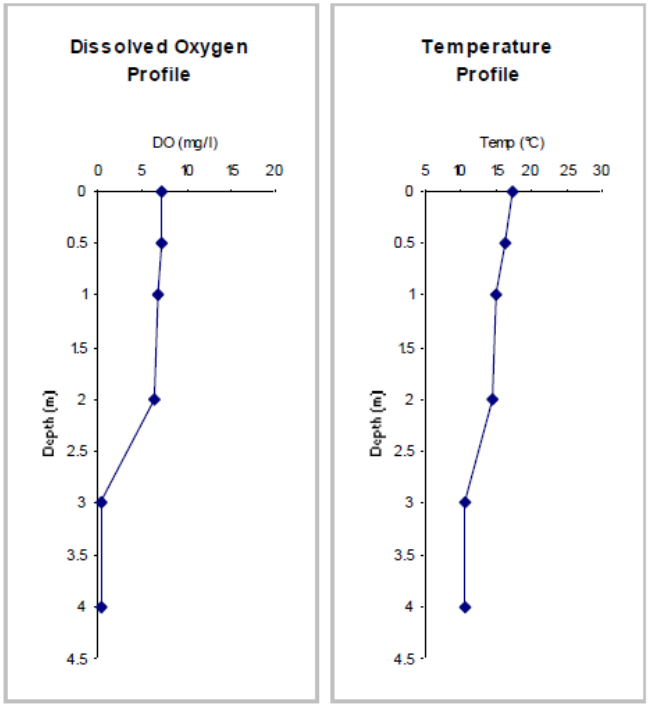
The lake substrate is predominantly silt with large silt deposits present at the shallow western shore. At the eastern shore the lake substrates are predominantly sand. A few boulders are scattered throughout the site

Figure 11 Dissolved oxygen and temperature profile for Lough Achork (29/06/2014)

GPS Location	H0405555463
Maximum Depth (m)	5.2 m
Secchi Depth (cm)	47 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	7.24	17.3
0.5	7.23	16.3
1	6.9	15.1
2	6.38	14.5
3	0.42	10.7
4	0.47	10.6



Sediment load

At the western end of the lake there are large silt deposits. It is likely that this is inwashed sediment caused by forestry operations, especially planting and clear-fell operations within the catchment.

Indicators of local distinctiveness

None noted

Summary

Lough Achork is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”. The lough but does not however achieve the necessary floristic requirement as defined within the CSM guidance (JNCC 2015) for an oligotrophic water body. No isoetid species are present in either the 2014 nor were any recorded in 1988 (NILS). Two characteristic oligotrophic to mesotrophic species were present in 2014 and below the coverage needed to meet the target for favourable condition.

The Lough fails to meet favourable condition in respect to water quality, with TP levels well in excess of the CSM guidelines. There is also evidence of increased sediment load at the western end of the site, most likely as a result of forestry operations. Destabilisation of the peats may also have resulted in increased DOC levels and colour in the lough, but without longer-term data the potential impact cannot be confirmed.

The species composition of the lake appears to be stable however, and likely to be limited by light in the brown water rather than other water quality parameters. Palaeoecological work would help to identify if there have been any longer-tern shifts

in both water quality and vegetation history in the lough associated with land use change.

Forest operations should be conducted in a manner to minimise and ecological damage to the site; this included minimising sediment and nutrient loads to the lough. The site is stocked by DCAL with brown trout only. Stocking rates should be low and anglers encouraged to minimise any risk of spreading non-native invasive species to and from sites.

The current survey places the lough in **unfavourable condition**.

Table 39 Lough Achork: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Achork NI Lake 630	**Unfavourable**	High TP levels Only 2 characteristic species present Appears to be increased sedimentation	Heavy sediment load in parts of the lough. High DOC reducing light penetration into the water column and therefore possibly unlikely to expect isoetid flora at this site. *P. alpinus* present in good abundance. Palaeoecological work would help to ascertain a site specific baseline for the lough

Species list

Table 40 List of all plant species recorded at Lough Achork in 2014

Marginal & Emergent species	**Abundance (DAFOR)**
Salix sp.	F
Juncus acutiflorus	F
Carex rostrata	F
Phragmites australis	F
Eleocharis palustris	O
Equisetum fluviatile	O
Caltha palustris	O
Galium palustre	O
Menyanthes trifoliata	R
Mentha sp.	R
Valeriana officinalis	R
Juncus effusus	R
Ranunculus flammula	R
Angelica sylvestris	R
Carex echinata	R
Myosotis laxa	R
Carex nigra	R
Potentilla palustris	R
Lychnis flos-cuculi	R
Schoenoplectus lacustris	R
Veronica scutellata	R
Cardamine pratensis	R
Pedicularis palustris	R
Typha latifolia	R
Filipendula ulmaria	R
Glyceria declinata	R
Carex sp.	R
Submerged & floating species	**% Frequency (n = 38)**
Chara virgata	3
Fontinalis antipyretica	37
Potamogeton alpinus	68
Potamogeton natans	+
Potamogeton obtusifolius	2
Nuphar lutea	32
Sparganium angustifolium	8

Survey data

Site Condition Assessment: Achork Lough (29/06/2014)

Lake Details		Survey Details		
Lake Name	Achork Lough	Survey Date	29/06/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H041555	Wader Surveys	3	3
WBID / NI No.	50327 / 630	Boat Surveys	2	sections

Site Notes:

Survey Notes:
Public path around the lough. Forestry and fishing.
No boat survey for section 3 due to absence of plants > 75cm. Very warm day.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	75 cm
		Compass bearing of boat transect (°)	264 °
		Lateral distance from waters edge to 75cm depth (m)	30 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	130 cm
		Compass bearing of boat transect (°)	162 °
		Lateral distance from waters edge to 75cm depth (m)	2 m
		Notes: transect just short of 100m due to angler present	
Section	**3**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	30 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0398155471	H0399355405	H0395155451	H0398055444
Section	**2**	H0404055391	H0412155419	H0408355457	H0408255424
Section	**3**	H0428555560	H0425655464	H0428955509	-

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0120	0122	0121
Section	**2**	0123	0124	0125
Section	**3**	0126	0127	none

3.7. Lough Vearty 638 (LA, VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	28 August 2014
NI Lake Number:	638
WBID:	50025
County:	Fermanagh
Grid reference:	G994658
OS Grid reference (X,Y):	199467,365884
Shoreline development index:	1.678
Surface area (ha.):	47
Maximum recorded depth (m):	7.2

Table 41 Condition Assessment Summary Table for Lough Vearty

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed	✓	5 present: *Elatine hexandra, Isoetes lacustris, Littorella uniflora, Lobelia dortmanna, Sparganium angustifolium*.
	Mesotrophic: ≥ 8 characteristic species listed	✓	8 characteristic spp.: *Baldellia ranunculoides, E. hexandra, I. lacustris, L. uniflora, L. dortmanna, Nitella translucens, S. angustifolium, Utricularia minor.*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	Loss of 2 characteristic spp. since 2006 (see text).
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	91% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	0% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	**✓?**	Few areas of fringing emergent vegetation (*S. lacustris*, *C. rostrata* and *Juncus* spp.), giving way to *Myrica* and *Calluna/Erica* & *Molinia* grassy moorland. *E. hexandra, L. dortmanna, J. bulbosus* and *L. uniflora* abundant in shallow water. *I. lacustris* common in both shallow and slightly deeper water. Dense patches of *N. lutea* at ≥75 cm in NE (S1). *N. alba* in S (S4). *Nitella translucens*. ≥100 cm in N (S1) & S (S4). *C. virgata* 50 cm in N (S2). Patches of *P. polygonifolius & U. minor. B. ranunculoides* in the south (S4)
	Maximum depth distribution should be maintained	**X**	Z_{max} = 7.2 m, Z_s = 3.71 m, Z_v = 2.8 m.
	At least the present structure should be maintained	**✓?**	Broadly similar structure to the last survey (2006), although a greater depth discovered.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	✓	TP = 12 μgl^{-1} (range 11-14) & TN = 0.4 mgl^{-1} (April '14 – Feb '15). ~ favourable for mesotrophic.
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.9 (range = 6.7 – 7.1).
	Adequate dissolved O_2 throughout the water column (water > 7 mgl^{-1} below thermocline)	✓	Waters well mixed and oxygenated throughout water column: Mean DO = 10.1 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	None recorded
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	Predominantly peat catchment. Peaty in the N, mainly cobbles in S. Silts in the open water

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓?	Sheep grazing observed, but extent of poaching unknown. Evidence of peat cutting.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓?	Impact of grazing unknown.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 47 ha with no loss of extent to the open water, although water levels were slightly low at the time of survey.

Macrophyte community composition

Lough Vearty lies within a catchment of shallow peats and small areas of exposed bedrock. In terms of mesotrophic species, no characteristic broadleaf *Potamogeton* spp. were recorded in 2014 and only one species (*P.alpinus*) recorded in 2006 and only at very low frequency (3%). One non-characteristic broadleaf *Potamogeton* spp (*Potamogeton polygonifolius*) and eight other characteristic species were recorded in 2014: *Baldellia ranunculoides, E. hexandra, I. lacustris, L. uniflora, L. dortmanna, Nitella translucens, S. angustifolium* and *Utricularia minor.* 91% of vegetated sample spots had ≥ 1 characteristic mesotrophic species therefore achieving the favourable condition target for characteristic species abundance. Other submerged and floating-leaved aquatic macrophyte taxa growing in the lough were *Chara virgata*, *Juncus bulbosus*, *Nuphar lutea, Nymphaea alba and Fontinalis antipyretica.* Marginal emergent vegetation occurred in small patches around the lough, comprising *Schoenoplectus lacustris, Carex* spp. (*Carex rostrata* and three other species) and *Juncus* spp. (*Juncus acutiflorus, Juncus bulbosus, Juncus effuses* and *Juncus articulatus*), giving way to *Myrica gale*, *Calluna vulgaris, Erica cinerea* and *Molinia caerulea* grassy moorland away from the edges.

Species recorded in 2006 but absent from the 2014 survey were *Potamogeton natans, P. alpinus and Nitella flexilis* agg. Species recorded in 2014 but not in 2006 were *Fontinalis antipyretica and Nymphaea alba*, the later being recorded in the 1990 survey. The survey performed in 2006 only consisted of 2 sections without boat surveys. The 2014 survey consisted of 4 sections with 4 boat surveys; however none of the sections overlap between the 2 survey years. Despite the variation in extent of surveyed area between 2006 and 2014 the dominant species remain similar across years and the slight variation in species is not thought to represent a significant change in the lough's condition.

In 2006 a high frequency (82% across the wader surveys) of *J. bulbosus* was recorded which was suggested to be indicative of nutrient enrichment. It was noted however that the high frequency may be a result of the lack of boat transects artificially inflating *J. bulbosus* cover. The 2014 survey which included boat transects recorded a lower *J. bulbosus* cover (44%) which although still above the CSM guidance (JNCC, 2015) for oligotrophic lakes it is of much less concern than in 2006 and proves the importance of both boat and wader based transect methods.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site (Table 42) are comparable to those calculated from the 1990 and 2006 suggesting minimal change in trophic status in that time.

Table 42 Aquatic macrophyte community composition for Lough Vearty, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=38)***	**TRS**	**PLEX**	**% occurrence (n=127)***
Baldellia ranunculoides	**-**	**-**	**+**	**-**	**-**	**3.1**
Chara virgata	8.5	7.69	16	8.5	7.69	0.8
Elatine hexandra	**6.0**	**5.38**	**39**	**6.0**	**5.38**	**15.7**
Isoetes lacustris	**5.0**	**4.23**	**29**	**5.0**	**4.23**	**36.2**
Juncus bulbosus	3.7	3.08	82	3.7	3.08	44.1
Littorella uniflora	**6.7**	**4.23**	**50**	**6.7**	**4.23**	**17.3**
Lobelia dortmanna	**5.0**	**3.08**	**55**	**5.0**	**3.08**	**55.1**
***Nitella flexilis* agg.**	**5.5**	**5.38**	**5**	**-**	**-**	**-**
Nitella translucens	**5.5**	**5.38**	**29**	**5.5**	**5.38**	**29.1**
Nuphar lutea	8.5	6.92	16	8.5	6.92	13.4
Potamogeton alpinus	**5.5**	**5.38**	**3**	**-**	**-**	**-**
Potamogeton natans	6.7	4.23	+	-	-	-
Potamogeton polygonifolius	3.0	3.08	+	3.0	3.08	3.1
Sparganium angustifolium	**3.0**	**4.23**	**+**	**3.0**	**4.23**	**2.4**
Utricularia minor	**4.0**	**3.08**	**11**	**4.0**	**3.08**	**0.8**
Average score	**5.5**	**4.67**		**5.4**	**4.58**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes a species from outside the survey sections, seen growing in the lough or present in the strandline

Negative indicator species

No alien or nuisance species were recorded from the site.

Macrophyte community structure

The border with the Republic of Ireland crosses the Lough from northeast to southwest. In 2006 only 2 sections were surveyed on the Northern Ireland side of the border. In the most recent survey 4 sections were surveyed with the first section sitting within the Republic side and the remaining 3 within the Northern Ireland side. To the northeast of the lough there is wet heathland dominated by bryophytes. To the southeast the shoreline is rocky. Patches of fringing emergent vegetation grow around the lough, except along stretches of rocky and/or exposed shore (e.g. S2). The marginal emergent vegetation comprised a mixed sward of *Carex* spp., *Juncus* spp. and *S. lacustris,* giving way to *Myrica gale*, *Calluna/ Erica* and *Molinea caerulea* grassy moorland away from the edges.

The *Littorelletea flora*, which is often found in distinct zones in oligotrophic loughs was present in Lough Vearty, with *Nitella transulcens* occurring to depths upto 2.9m, *Isoetes lacustris* inhabiting a zone from 2-1m overlapping with *Lobelia dortmanna* at 1.8m and *Littorella uniflora* inhabiting the shallower margins. The water, although slightly brown, was clear enough during the survey to allow light penetration to 370 cm, with the aquatic vegetation extending to a depth of 290 cm (*N. translucens*). Overall, the distribution of aquatic macrophytes in Lough Vearty was rather patchy and to some extent dependent upon habitat availability. However abundances were generally high within each patch. The current structure is considered favourable.

Water quality

The water chemistry of Lough Vearty is typical for an oligotrophic lough, having a slightly acidic pH and low nutrients and ionic concentration. Unlike the dystrophic sites of the Garron Plateau the water colour in the lough is much lighter brown and consequently light penetration is higher (Z_s = 371 cm). Total phosphorus is only slightly higher than the oligotrophic limit set in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015), total nitrogen was low and the lough shows limited direct evidence of the effects of nutrient enrichment: i.e. filamentous algae cover is low and Chl *a* is low. Trophic conditions are therefore borderline, but are assessed as favourable for a site that exhibits both oligo- and mesotrophic elements in its chemistry and flora and appears to be stable in terms of nutrients. Other water quality parameters are consistent with the lake type (i.e. oligotrophic, LA Sh) and comparison of the 1990, 2006 and 2014 water chemistry data suggests that there has been little change in water quality over the last 24 years (although care should be taken in drawing conclusions from the 1990 data as this was a one off spot sample). At the time of survey, the lake was well mixed and oxygen concentrations were high (Mean DO throughout water column was 10.1 mgl^{-1}).

Hydrology

Lough Vearty has no apparent inflow streams. The lough drains to the south into a stream which subsequently joins the Garvary River, which continues to flow south into Lower Lough Erne. The hydrological regime at the site appears natural.

Lake substrate

The lake margins are mixed. Section 1 & 2 predominantly comprises vegetated peat, whereas Section 3 largely comprises coarse mineral substrates (mainly cobbles) interspersed with silts. Section 4 is predominantly silt as are the open water substrates.

Sediment load

Although not apparent on the ground in 2014, aerial photography indicates that peat cutting occurs in the catchment, particularly on the north-western shore where cutting occurs to within a few metres of the lake shore. Also sheep grazing was noted in 2006 and 2014. Although there was no direct evidence of increased sediment load to the site, the high frequency of *Juncus bulbosus* may provide indirect evidence of an increase in sedimentation.

Table 43 Water chemistry data for Lough Vearty

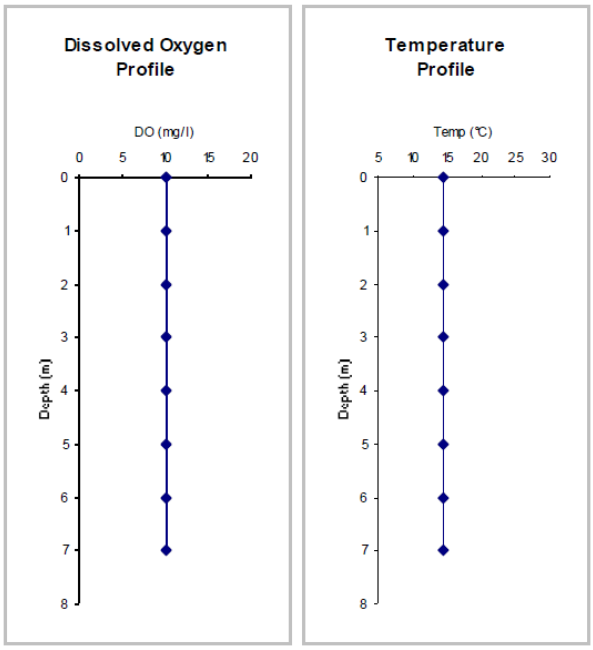
	Apr '14	Aug '14	Nov '15	Feb '15	Mean	2006	1990
TP	12.2	14.1	12.8	10.8	**12.5**	11.0	15.0
SRP	<1.0	<1.0	<10	1.5	**<1.1**	n/a	n/a
TN	0.3	0.4	0.4	0.3	**0.4**	0.6	0.6
TON	<0.005	<0.005	0.026	0.070	**<0.027**	n/a	n/a
Nitrite	<0.001	<0.001	<0.001	<0.001	**<0.001**	n/a	n/a
Chl *a*	2.64	1.65	3.19	0.071	**1.9**	4.5	2.39
DOC	5.0	6.1	6.5	5.5	**5.8**	n/a	n/a
pH	7.0	7.1	7.0	6.7	**6.9**	6.4	7.0
Alk	7.0	9.0	10.0	<5.00	**<7.75**	8.8	0.1
Cond	72.0	73.0	70.0	76.0	**72.8**	61.0	126.0
Ca^{2+}	2.4	2.9	3.0	2.4	**2.7**	3.3	3.2
Mg^{2+}	1.4	1.6	1.4	1.5	**1.5**	0.9	2.0
Na^{+}	9.6	9.3	8.8	10.1	**9.4**	6.6	4.4
K^{+}	0.5	0.5	0.7	0.7	**0.6**	0.8	0.3
Cl^{-}	17.7	16.8	16.4	19.0	**17.5**	8.1	25.7
SO_4^{2-}	<10	2.4	2.4	3.2	**<4.5**	2.8	6.1

Figure 12 Dissolved oxygen and temperature profile for Lough Vearty (28/08/2014)

GPS Location	G9959966076
Maximum Depth (m)	7.2 m
Secchi Depth (cm)	3.71 cm

Notes: DO profile probably not verticle due to high winds and poor anchorage.

Depth (m)	DO (mg/l)	Temp (°C)
0	10.13	14.4
1	10.07	14.4
2	10.1	14.4
3	10.13	14.4
4	10.1	14.4
5	10.13	14.4
6	10.04	14.4
7	10.07	14.4



Indicators of local distinctiveness

Elatine hexandra is rare in Northern Ireland, its continued presence in Lough Vearty is reassuring but it should be monitored in future. It was not recorded from this site in 1990.

Summary

Lough Vearty is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*” and achieves the necessary floristic requirement as defined within the CSM guidance (JNCC 2015) for an oligotrophic water body. Five characteristic oligotrophic species were present in 2014 along with three additional mesotrophic taxa (including *Baldellia ranunculoides* growing near the jetties at the south end).

Comparison of the 1990, 2006 and 2014 macrophyte survey data suggests that the aquatic macrophyte flora has remained relatively stable over the last 24 years, with similar dominant species recorded in all years. Small differences can mostly be attributed to survey methods and survey coverage, i.e. no boat surveys in 2006. The frequency of *J. bulbosus* may still be of concern, as it was in 2006, and may reflect increasing sedimentation rates around the lough’s shores, perhaps in relation to shoreline disturbance through poaching and/or peat cutting within the catchment (although this is unconfirmed). Currently the frequency of *Juncus bulbosus* is just above the threshold value set out in the CSM guidance (JNCC 2015) for an oligotrophic water body. It is recommended that more regular monitoring is undertaken to establish if the aquatic flora is stable (3 year cycle). The current survey places the lough in **favourable, at risk** condition.

Table 44 Lough Vearty: Overview

Water Body	Status	Reason(s) for concern	Comments
Lough Vearty NI Lake 637	**Favourable (at risk)**	TP is stable, but just above upper limit for oligotrophic loughs. High frequency of *Juncus bulbosus*	Good representation of characteristic species and diverse aquatic macrophyte flora for this lake type. Notable species; *B. ranunculoides* present in 2006 and 2014. Dominant species similar in 1990, 2006 and 2014 Some concern over high frequency of *J. bulbosus* in marginal areas. Extent and impact of peat cutting and grazing intensity are unknown. Site would benefit from more regular monitoring of water quality and flora.

Species list

Table 45 List of all plant species recorded at Lough Vearty in 2014

Marginal & Emergent species	**Abundance (DAFOR)**
Angelica sylvestris	R
Baldellia ranunculoides	R
Callitriche sp.	R
Carex demissa	R
Carex rostrata	R
Eleocharis multicaulis	R
Filipendula ulmaria	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Juncus articulatus	R
Juncus bulbosus	O
Juncus effusus	R
Littorella uniflora	R
Pellia epiphylla	R
Persicaria amphibia	R
Phragmites australis	R
Potentilla palustris	R
Ranunculus flammula	R
Sphagnum sp.	R
Succisa pratensis	R
Submerged & floating species	**% Frequency (n = 127)**
Baldellia ranunculoides	3
Chara virgata	1
Elatine hexandra	16
Isoetes lacustris	36
Juncus bulbosus	44
Littorella uniflora	17
Lobelia dortmanna	55
Nitella translucens	29
Nuphar lutea	13
Potamogeton polygonifolius	3
Sparganium angustifolium	2
Utricularia minor	1

Survey data

Site Condition Assessment: Vearty Lough (28/08/2014)

Lake Details		**Survey Details**		
Lake Name	Vearty Lough	Survey Date	28/08/2014	
SSSI Name		Surveyors	SD &	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	G995659	Wader Surveys	4	4
WBID / NI No.	50025 / 638	Boat Surveys	4	sections

Site

Survey
4 x sections with boat transects. Only 2 sections completed last survey (2006) without boat transects. Sections from this survey do not overlap with those of the last. Very windy day. Glyceria sp. Seen on the banks of section 4

Section Summaries

Section 1	Maximum depth of colonisation (cm)	140 cm
	Compass bearing of boat transect (°)	309 °
	Lateral distance from waters edge to 75cm depth (m)	8 m
	Notes: lateral distance greater in sub sections 1& 2	
Section 2	Maximum depth of colonisation (cm)	180 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	8 m
	Notes: Steep shelving made boat based survey difficult	
Section 3	Maximum depth of colonisation (cm)	280 cm
	Compass bearing of boat transect (°)	69 °
	Lateral distance from waters edge to 75cm depth (m)	8 m
	Notes:	
Section 4	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	211 °
	Lateral distance from waters edge to 75cm depth (m)	8 m
	Notes: depth of 2m >200m from the shore.Nitella dominates	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end
Section 1	G9954666292	G9958666384	G9954866343	G9962066349
Section 2	G9984466009	G9978766092	G9981666051	G9981166038
Section 3	G9973965660	G9979165576	G9975765612	G9972365605
Section 4	G9920865367	G9925765455	G9923965469	G9930965773

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0249	0251	0250
Section 2	0252	0254	0253
Section 3	0255	0256	0257
Section 4	0258	0259	0260

3.8. Meenaghmore Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	17 June 2015
NI Lake Number:	642
WBID:	50510
County:	Fermanagh
Grid reference:	G992642
OS Grid reference (X,Y):	199258,364250
Shoreline development index:	1.543
Surface area (ha.):	1.25
Maximum recorded depth (m):	1.0

Table 46 Condition Assessment Summary Table for Meenaghmore Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓?	Possible infilling due to increased sedimentation.
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic Littorelletea species (≥ 2 if valid reasons suggest otherwise)	✓	3 characteristic *Littorelletea* species present: *Littorella uniflora, Lobelia dortmanna, Sparganium angustifolium.*
	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	X	No characteristic broadleaf *Potamogeton* spp. and only 4 other characteristic spp.*: L. uniflora, L. dortmanna, N. flexillis* agg. *N. translucens* and *S. angustifolium.*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	Possible loss of *Utricularia minor* and *Utricularia vulgaris* since 1988.
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	33% of vegetated sample spots comply for oligotrophic species. 51% for mesotrophic spp. This is improved since 2006
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	No filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present (see Table 4)	✓**?**	Lough surrounded by *Molinia, Myrica* and *Calluna* moorland. *Sphagnum* spp. bog (topped by *C. rostrata, C. limosa, Myrica* and *M. trifoliata*) around S/SE margins to ~50 cm. *C. rostrata* = dominant around margins. Some *P. australis* amongst *C. rostrata* in northeast. Open water very shallow and macrophytes patchy – sparse *P. natans* (50-100 cm) & *E. fluviatile* (0-100 cm) to S/SE. *S. angustifolium* in centre of lough. Patches of *N. translucens* in centre and to E (≥50 cm). Patch of *E. fluitans* to W at ~25 cm.
	Maximum depth distribution should be maintained	✓	Zmax = 1.0 m, Zs = 0.65 m, Zv = 1.0 m.
	At least the present structure should be maintained	✓	Slight improvement since 2006
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1}	**X?**	TP = 11.8 μgl^{-1} (range 6-19) & TN = 0.52 mgl^{-1} (Apr'14 – Feb'15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.3 (range = 5.9 – 7.3).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	Waters well oxygenated and completely mixed to 1.0 m: DO = 9.4 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	**X**	Mechanical peat cutting to shore.
Lake substrate	Natural shoreline maintained	**X**	Mechanical peat cutting to shore

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	**X**	Predominantly peat catchment. Possible peat erosion and increased deposition.
Sediment load	Natural sediment load maintained	**X?**	Heavy grazing pressure / poaching around lough and peat cutting around NE lake shore may be increasing sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	**X?**	Peat cutting and heavy grazing / poaching observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is approximately 1.25 ha. The lough lies within a basin with extensive peat development and the north shore has vertical peat "cliffs" of up to 2 m high. The west and south-west of the basin have in filled with fine peaty sediments which are becoming terrestrialised away from the lough, but near the edges form deep unconsolidated areas of fluid sediment which support very little aquatic vegetation. The surface area of the lough has therefore reduced over time by approximately 25% and this appears to be on-going.

Whether this infilling is entirely natural or not is unknown, but there is evidence to suggest it may have been accelerated by poor catchment management. The deep peat directly north of the site has undergone mechanical extraction over the past 10 years, with the plough having been dragged from right down at the lough margins in places and the direction of cutting is mainly down-slope to the lough shore. This area has subsequently been grazed by cattle and become heavily denuded where the cutting has destroyed the overlying vegetation. It is very likely that the peat cutting and cattle poaching will have caused significant destabilisation and erosion of the peat which is causing increased deposition in the lough. The current situation is unfavourable.

Macrophyte community composition

Meenaghmore Lough lies within a catchment of shallow peats and small areas of exposed bedrock. The peat hag bank tops were characterised by a mixed heathland sward, dominated by *Calluna vulgaris, Myrica gale* and *Molinia caerulea*. Relatively large areas of wetland extend to the west and south-west of the site (see above) comprising *Sphagnum* spp. bog topped by *Carex rostrata, Carex limosa*, *Menyanthes trifoliata* and *M. gale* as well as extensive stands of *C. rostrata* to the west and areas of sparse growth of *Equisetum fluviatile*, a range of *Carex* spp., *Juncus effusus / articulatus* and occasional *Phragmites australis* along the north east shore. Characteristic oligotrophic species recorded growing in the lough were *Littorella uniflora, Lobelia dortmanna and Sparganium angustifolium*. *Nitella translucens* and *N. flexilis* agg. was also recorded, although these are characteristic species of richer, mesotrophic sites. Other non-characteristic submerged and floating leaved species recorded in 2006 were *Eleogiton fluitans, Juncus bulbosus,*

Potamogeton natans, P. polygonifolius (in the wetlands only), *Utricularia minor* and *Nuphar lutea.*

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 5.2 and 4.16 respectively (Table 47). These scores are similar to those calculated from the 2006 survey data. The current assemblage is very similar to that recorded in 2006 and includes two additional species also recorded in the 1988 NILS data, *Utricularia minor* and *Potamogeton polygonifolius*. The increase in *S. angustifolium* since 2006 is explained by an extra boat survey added in 2015, this species being found mainly in open water.

Table 47 Aquatic macrophyte community composition for Meenaghmore Lough, including trophic scores.

	2006			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=28)***	**TRS**	**PLEX**	**% occurrence (n=43)***
Eleogiton fluitans	4	3.08	4	4	3.08	2
Juncus bulbosus	3.7	3.08	29	3.7	3.08	21
Littorella uniflora	**6.7**	**4.23**	**21**	**6.7**	**4.23**	**2**
Lobelia dortmanna	**5**	**3.08**	**7**	**5**	**3.08**	**5**
Menyanthes trifoliata	5.3	-	4	5.3	-	+
***Nitella flexilis* agg.**	**-**	**-**	**-**	**6.7**	**5.5**	**7**
Nitella translucens	**5.5**	**5.38**	**14**	**5.5**	**5.38**	**30**
Nuphar lutea	8.5	6.92	+	8.5	6.92	7
Potamogeton natans	6.7	4.23	36	6.7	4.23	12
Potamogeton polygonifolius	-	-	-	3	3.08	+
Sparganium angustifolium	**3**	**4.23**	**+**	**3**	**4.23**	**28**
Utricularia minor	-	-	-	4	3.08	2
Average score	**5.4**	**4.28**		**5.2**	**4.16**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

No alien or nuisance species were recorded from the site and there was no filamentous algae present.

Macrophyte community structure

Molinia caerulea, Myrica gale and *Calluna vulgaris* grassy heathland grows on the peat hags surrounding the lough to all sides. An almost continuous zone of fringing emergent vegetation (*C. rostrata*, *C. limosa*, and with occasional *P. australis* & *M. trifoliata*) grows on *Sphagnum* spp. bog around the western and south-western lough margins to a maximum water depth of ~50cm. The water was very brown during the 2015 survey and notably browner than in 2006 when the Secchi was visible on the lough bed at 1.0 m, compared to only 65 cm in this survey.

The *Littorelletea flora*, which is often found in distinct zones in oligotrophic loughs was confined to a short section of the northeast shore (S1) and showed no obvious zonation pattern. Furthermore, *Littorella uniflora* was recorded as "frequent" in 1988 (NILS), it was only occasional in 2006 and was less frequent (and at lower abundance) in 2015. The decline of this species in the lough is of major concern and a primary reason for down-grading the site to unfavourable condition. No *Isoetes lacutris* has been recorded from the site which is probably due to it being very shallow and wind-stressed. Instead of any obvious zonation, the aquatic flora in Meenaghmore Lough is patchy and restricted mainly to the north and west, with the south and east of the site having rather fluid sediments and few plants. In the open water, the vegetation was sparse, but *S. angustifolium* and *N. translucens* were recorded at relatively high frequency, growing at water depths ≥50 cm. The current structure is relatively poor, but the site is very shallow and wind stressed and therefore does not have the range of potential habitats normally associated with oligotrophic sites.

Water quality

The water chemistry of Meenaghmore Lough is typical for an oligotrophic lough, having a slightly acidic pH and low nutrients and ionic concentration. Total phosphorus is slightly above the target level set in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015), however it is recognised that the interaction of nutrients in peat dominated sites is complex and therefore elevated TP is not always indicative of unfavourable conditions. This is particularly apparent at this site where nitrogen concentrations are very low and the lough shows limited direct evidence of the effects of nutrient enrichment. Filamentous algae cover was very low and Chl *a* remained very low throughout the year. The water quality appears to have remained relatively stable since 1988 (Table 48). The site is wind stressed and shallow resulting in well oxygenated water (DO from 0 - 50 cm was 9.4 mgl^{-1}, Figure 13).

Lake substrate

The lake is surrounded on most sides by vegetated peat hags. Hard substrates around the south and west shores have considerable build-ups of very soft organic sediments (peat) in excess of 80 cm deep in places. Given the extent of peat extraction and subsequent denudation by cattle to the northern side of the lough, it is considered likely that the site has suffered increased sedimentation resulting in unsuitable substrates for a *Littorelletea flora* and accelerated in-filling. The more exposed east and northern margins have more consolidated silt and peat substrates and areas of exposed gravel and rock. This situation is unfavourable.

Sediment load

As discussed above, it is likely that the site has suffered from increased sediment loads due to peat extraction and subsequent cattle grazing on exposed peat. This situation is unfavourable.

Indicators of local distinctiveness

None specified.

Table 48 Water chemistry data for Meenaghmore Lough

	Apr'14	Aug '14	Nov '14	Feb'15	Mean	2006	1988
TP	14.1	8.7	18.7	5.5	**11.8**	15	15
SRP	1.6	1.0	2.7	1.0	**<1.6**		
TN	0.570	0.630	0.680	0.200	**0.520**	0.64	0.31
TON	0.056	0.007	0.032	0.024	**0.030**		
Nitrite	0.003	0.001	0.001	0.001	**<0.001**		
Chl *a*	3.1	2.2	4.8	1.7	**3.0**	8.4	3.9
DOC	8.6	14.3	12.0	2.8	**9.41**		
pH	7.23	6.87	6.20	5.89	**6.28**	6.0	6.9
Alk	7.0	13.0	6.0	5.0	**<7.8**	4.2	0.1
Cond	70	65	49	104	**72**	62	114
Ca^{2+}	2.4	3.3	1.6	2.1	**2.3**	3.3	3.1
Mg^{2+}	1.4	1.6	0.9	2.0	**1.5**	0.7	2.0
Na^{+}	9.0	8.3	6.6	14.3	**9.6**	6.8	3.1
K^{+}	0.4	0.4	0.8	0.6	**0.5**	0.7	0.8
Cl^{-}	16.2	14.1	12.0	28.6	**17.7**	8.3	27.4
SO_4^{2-}	10.0	1.6	1.8	4.6	**<4.5**	4.0	5.9

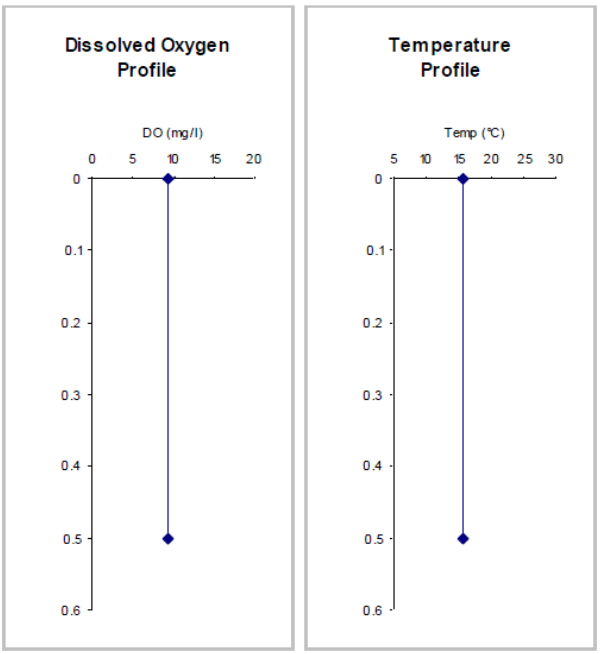
Figure 13 Dissolved oxygen and temperature profile for Meenaghmore Lough (17/06/2015)

Dissolved Oxygen Profile

GPS Location	G9923364264
Maximum Depth (m)	1 m
Secchi Depth (cm)	65 cm

Notes: Shallow and wind stressed

Depth (m)	DO (mg/l)	Temp (°C)
0	9.43	15.8
0.5	9.4	15.8



Summary

Meenaghmore Lough is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”.

Following the 2006 survey, the site was classified as being in favourable condition, but at risk due to poor catchment management. Although the site still supports 3 characteristic oligotrophic species (*L. uniflora, L. dortmanna* and *S. angustifolium*), they occur below the target frequency and there has been a successive decline in the frequency and abundance of *Littorella uniflora* since 1988. This latter point combined with evidence of significantly increased sediment loads due to the very poor land management to the north of the site classifies it as **unfavourable** (JNCC 2015).

Being very shallow, Meenaghmore Lough is particularly susceptible to increased sedimentation and infilling and hence requires management intervention to slow this process and prevent any further decline. Management should focus on the restoration of the peat cuttings to the north of the site to prevent further degradation and erosion of the peat and impact to the lough. Such management would be facilitated by better evidence of changes to sedimentation rates through the analysis of lake cores (e.g. Bennion *et al.* 2010). Despite the problems associate with land management around the lough, the water quality at the site appears to have remained stable with respect to nutrients.

Table 49 Meenaghmore Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Meenaghmore Lough NI Lake 643	**Unfavourable**	Decline in *Littorella uniflora* Accelarated siltation and loss of extent. Low cover of characteristic species Poor land management adjacent to site	Although water quality at the site is relatively good, the concerns over increased sedimentation and decline of *L. uniflora* are unfavourable. Peat cuttings and poor land management along north-eastern shore

Species list

Table 50 List of all plant species recorded at Meenaghmore Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Agrostis stolonifera	R
Calluna vulgaris	F
Cardamine pratensis	R
Carex curta	R
Carex echinata	R
Carex limosa	O
Carex nigra	R
Carex panicea	R
Carex rostrata	F
Carex viridula subsp. *oedocarpa*	R
Drosera intermedia	R
Drosera rotundifolia	R
Equisetum fluviatile	F
Galium palustre	R
Galium saxatile	R
Hydrocotyle vulgaris	R
Juncus articulatus	R
Juncus effusus	F
Menyanthes trifoliata	R
Myrica gale	R
Pellia epiphylla	R
Phragmites australis	R
Polygala serpyllifolia	R
Polytrichum commune	R
Potentilla erecta	R
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	R
Sphagnum sp.	F
Viola palustris	R
Submerged & floating species	**% Frequency (n = 43)**
Eleogiton fluitans	2
Juncus bulbosus	21
Littorella uniflora	2
Lobelia dortmanna	5
Nitella flexilis agg.	7
Nitella translucens	30
Nuphar lutea	7
Potamogeton natans	12
Potamogeton polygonifolius	+
Sparganium angustifolium	28
Utricularia minor	+

Survey data

Site Condition Assessment: Meenaghmore Lough (17/06/2015)

Lake Details		**Survey Details**		
Lake Name	Meenaghmore Lough	Survey Date	17/06/2015	
SSSI Name		Surveyors	BG & MST	
SAC Name		Shore Surveys	2	out of
Grid Ref	G993643	Wader Surveys	2	2
WBID / NI No.	50510 / 643	Boat Surveys	2	sections

Site Notes:
Mechanical peat extraction along north shore. Major impact on lake substrates - shore peat

Survey Notes:
W end with deep organic sediments over hard

looks to be recent accumulation of silt, as a result of

erosion in the immediate area. Water very brown

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	100 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	50 m
		Notes: Plants to max depth	
Section	**2**	Maximum depth of colonisation (cm)	75 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	100 m
		Notes: Plants to max depth	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	G9940964214	G9933764287	G9937864247	G9936164210
Section	**2**	G9925764177	G9918864243	G9921264190	G9932564244

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3264	3263	3262
Section	**2**	3267	3268	3269

3.9. Mallybreen Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*.

Survey Date	17 June 2015
NI Lake Number:	644
WBID:	50551
County:	Fermanagh
Grid reference:	H011661
OS Grid reference (X,Y):	201116,366036
Shoreline development index:	1.122
Surface area (ha.):	1.25
Maximum recorded depth (m):	2.3

Table 51 Condition Assessment Summary Table for Mallybreen Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic Littorelletea species (≥ 2 if valid reasons suggest otherwise)	✓	5 characteristic species*: Isoetes lacustris, Littorella uniflora, Lobelia dortmanna, Sparganium angustifolium* & *Utricularia australis.* .
	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	**X**	No characteristic broadleaf *Potamogeton* spp. and only 6 other characteristic spp.*:* as above plus *N. flexilis* agg.
	No loss of characteristic species	✓	No loss since 2006, and similar to 1988 assemblage.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	**X?**	50% of vegetated sample spots comply for oligotrophic species. 58% for mesotrophic spp. This is improved since 2006 (28 & 46% respectively)
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Low cover of filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	✓**?**	*Molinia, Myrica*, *Calluna* & *Erica* grassy heathland surrounds the lough. Patchy fringing emergent vegetation (mostly *C. rostrata*) to depth of ~ 75 cm. *J. bulbosus* common in shallow water (0-50 cm). *L. uniflora* & *L. dortmanna* confined to shallow margins (o – 80 cm). Patches of *M. alterniflorum* (25-140 cm). *N. alba* (25-75 cm) and sparse *P. natans* (50-75 cm) to W. Bed of *N. flexilis* agg. in central lough basin (75-140 cm). Small patch of *N. lutea* to NW. *C. virgata* scarce. *I. lacustris* at 25-110 cm. Vegetation distribution patchy – no clear zonation.
	Maximum depth distribution should be maintained	✓	Z_{max} = 2.3 m, Z_s = 1.4 m, Z_v = 1.4 m.
	At least the present structure should be maintained	✓	Slight improvement since 2006
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1}	✓	TP = 4.6 μgl^{-1} (range 2.5-6.8) & TN = 0.36 mgl^{-1} (Apr'14 – Feb'15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓**?**	pH = 5.6 (range = 5.1 – 7.7).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	Waters well oxygenated and completely mixed to 2.3 m: DO ~ 9.0 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓	Natural
Lake substrate	Natural shoreline maintained	✓	Natural

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	✓	Predominantly peat catchment. Peat hags along south shore, boulders around other littoral areas. Silts in open water.
Sediment load	Natural sediment load maintained	✓	Only light grazing pressure. No evidence of increased siltation.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified. Hen harrier seen April 2014
	Minimal negative impacts and no fish farming	✓	Remote site with low disturbance.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 1.25 ha with no loss of extent to the open water

Macrophyte community composition

Mallybreen Lough is a small, shallow lough that lies within a catchment of shallow peats and small areas of exposed bedrock topped by rough open heathland comprising *Calluna vulgaris, Erica cinerea, Myrica gale* and *Molinia caerulea*. The southern shoreline comprises overhanging *Calluna*-vegetated peat hags and the other lough margins comprise coarse mineral substrates. The marginal emergent vegetation is patchy and predominantly comprises beds of *Carex rostrata,* sparsely interspersed with *Phragmites australis* and *Juncus acutiflorus* to the west (S1). *Carex* spp. (7 species), *Schoenus nigricans*, *Juncus bulbosus*, *Sphagnum* spp. and Liverwort spp. are also common in the margins. The water, although slightly brown, was clear enough during the survey to allow light penetration to 140 cm, with the aquatic vegetation also extending to a depth of 140 cm.

Four characteristic *Littorelletea* species were recorded: *Isoetes lacustris, Littorella uniflora, Lobelia dortmanna* and *Sparganium angustifolium* (as well as *Utricularia australis*), and with the addition of more survey points the overall frequency of characteristic species increased from only 28% in 2006 to 50% in 2015. This was mainly an increase in the number of sample points in slightly deeper water with *I. lacustris* and *L. dortmanna* present. In addition to the characteristic oligotrophic species, *Nitella flexilis* agg. was recorded, a characteristic mesotrophic species as well as *Chara virgata, Juncus bulbosus, Menyanthes trifoliata, Myriophyllum alterniflorum, Nuphar lutea, Nymphaea alba*, *Potamogeton natans, P. polygonifolius*, *Sphagnum* spp and *Utricularia australis* (Table 52). The assemblage was similar to that seen in 2006, and an improvement on the NILS survey data from 1988 from which *I. lacustris* and *L. uniflora* were absent or overlooked.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 5.4 and 4.15 respectively. The scores are slightly lower than those calculated from the 2006 survey data (6.3 and 4.58), reflecting the presence of low scoring *U. australis, P. polygonifolius* and aquatic *Sphagnum* spp. in the 2015 survey data; all of which were rare.

Of additional note was the presence of freshwater sponges. These were verified as *Racekiela ryderii*, which although frequent in Ireland, there have been no records from Co. Fermanagh since 1920 (*Pers. comm.* Karen Evens, University of Liverpool)

Table 52 Aquatic macrophyte community composition for Mallybreen Lough, including trophic scores.

	2006			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=36)***	**TRS**	**PLEX**	**% occurrence (n=50)***
Chara virgata	8.5	7.69	3	8.5	7.69	4
Isoetes lacustris	**5.0**	**4.23**	**6**	**5.0**	**4.23**	**22**
Juncus bulbosus	3.7	3.08	33	3.7	3.08	20
Littorella uniflora	**6.7**	**4.23**	**6**	**6.7**	**4.23**	**6**
Lobelia dortmanna	**5.0**	**3.08**	**11**	**5.0**	**3.08**	**16**
Menyanthes trifoliata	5.3	-	+	5.3	-	2
Myriophyllum alterniflorum	5.5	4.23	28	5.5	4.23	44
Nitella flexilis agg.	**5.5**	**5.38**	**25**	**5.5**	**5.38**	**20**
Nuphar lutea	8.5	6.92	+	8.5	6.92	+
Nymphaea alba	6.7	3.08	14	6.7	3.08	20
Potamogeton natans	6.7	4.23	14	6.7	4.23	10
Potamogeton polygonifolius	-	-	-	3.0	3.08	+
Sparganium angustifolium	**3.0**	**4.23**	**14**	**3.0**	**4.23**	**8**
Sphagnums aquatic	-	-	-	3.7	1.54	4
Utricularia australis	-	-	**-**	**4.0**	**3.08**	**12**
Average score	**5.8**	**4.58**		**5.4**	**4.15**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

No alien species were recorded from the site and although *Myriophyllum alterniflorum* was present at 44% frequency, its abundance was mainly very low and it is not considered as negative at this site. Filamentous algae cover was mainly low.

Macrophyte community structure

The marginal emergent vegetation is confined mainly to beds of *C. rostrata* growing to water depths of ~75 cm. Within the littoral zone, *Juncus bulbosus* is locally frequent (0-75 cm) throughout the lough and in particular is locally abundant in S2. *Littorella uniflora* is uncommon in the lough, but *Lobelia dortmanna* and *Isoetes lacustris* were present at higher frequency, and although rarely forming large beds, were nonetheless well distributed in the site up to approximately 1.0 m. The open water submerged and floating leaved macrophyte flora has a rather patchy distribution with no clear zonation exhibited. *Myriophyllum alterniflorum* is frequent, in open water to 1.4 m, but was rarely more than a few plats per m^2. *Nymphaea alba* (25-80 cm) and sparse *P. natans* (50-75 cm) grow to the western side. *Nitella flexilis* agg. was recorded more commonly on the west side, but also in sparse beds

throughout the lough to 1.4 m. A small patch of *N. lutea* was recorded in the northwest of the site (outside of the sections). Submerged plants were sparse beyond 1.1 m and no plants were recorded growing beyond a water depth of 1.4 m. The current structure is considered favourable for a shallow, wind-stressed lough with brawn water.

Water quality

Table 53 Water chemistry data for Mallybreen Lough

	Apr'14	Aug '14	Nov '14	Feb'15	Mean	2006	1988
TP	4.9	6.8	4.2	2.5	**4.6**	11	22
SRP	<1.0	<1.0	<1.0	<1.0	**<1.0**	-	-
TN	0.340	0.560	0.380	0.140	**0.355**	0.83	0.83
TON	0.011	0.015	0.008	0.026	**0.015**	-	-
Nitrite	0.002	<0.001	<0.001	<0.001	**<0.001**	-	-
Chl *a*	0.7	1.9	1.0	0.8	**1.1**	6.1	38.1
DOC	6.1	11.4	8.9	4.0	**7.6**	-	-
pH	7.67	6.73	5.06	6.01	**5.61**	6.1	8.2(?)
Alk	<5.00	7.0	<5.00	<5.00	**<5.0**	3.6	-
Cond	66	54	32	88	**60**	59	123
Ca^{2+}	1.5	1.8	0.5	1.5	**1.3**	3.3	6.0
Mg^{2+}	1.3	1.4	0.5	1.8	**1.2**	1.6	2.4
Na^{+}	8.7	7.1	4.6	12.3	**8.2**	6.6	9.2
K^{+}	0.3	0.3	0.3	0.4	**0.3**	0.6	0.3
Cl^{-}	15.8	12.3	8.0	24.5	**15.2**	7.5	22.7
SO_4^{2-}	<10	1.6	1.4	3.9	**<4.0**	3.3	3.9

The water chemistry of Mallybreen Lough is typical for an oligotrophic lough, having a slightly acidic pH and very low nutrients and ionic concentration. Mean annual TP was just above the CSM threshold in 2006 (11 μgl^{-1}), but during 2014-15 was measured at only 4.6 μgl^{-1} and is therefore now well within CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015). Total nitrogen has also decreased since 2006 and is well within target values

The low nutrients result in low Chl *a* concentrations throughout the year and comparison of the current data with 2006 and 1988 water chemistry (Table 53) suggests that the lough has improved considerably over this period and is favourable with respect to water quality. The site is wind stressed and shallow resulting in well oxygenated water (DO from 0 – 2.0 m cm was ~ 9.0 mgl^{-1}, Figure 14).

Lake substrate

The lake margins are made up of both vegetated peat and silts (to the south) and areas of exposed bedrock and boulders and other coarser mineral substrates (to all other shores). The open water substrates are silty.

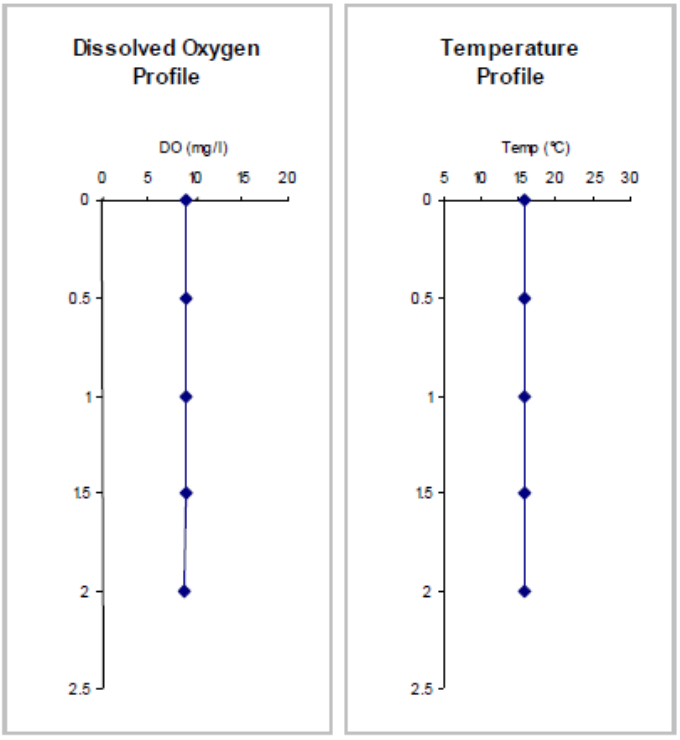
Figure 14 Dissolved oxygen and temperature profile for Mallybreen Lough (17/06/2015)

Dissolved Oxygen Profile

GPS Location	H0112366040
Maximum Depth (m)	2.3 m
Secchi Depth (cm)	140 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	9.03	15.9
0.5	9	15.9
1	9	15.9
1.5	8.97	15.8
2	8.95	15.8



Sediment load

There is no evidence to suggest the lough has increased sediment loads. Grazing within the catchment is low intensity and disturbance low.

Indicators of local distinctiveness

None specified.

Summary

Mallybreen Lough is classified as an "oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*". The lough was classified as being in favourable condition following the 2006 CSM survey, but deemed to be at risk due to the poor distribution of characteristic species within the site. Although still slightly below this target, the current survey data shows the site to have improved since 2006 (with 50% of vegetated sample spots having ≥1 characteristic species compared to 28 % in 2006). The classic zonation of the *Littorelletea* flora typically seen in deep clear water sites was not present in Mallybreen Lough, although this may be expected given the small size of the lough, limited habitat availability and the peaty brown water.

Comparison of the 1988, 2006 and 2015 water chemistry data suggests that the trophic status of the lough has improved and is now well within the TP target for this lake type (JNCC 2015). The dominance of *Juncus bulbosus* in 1988 was of concern, but this taxa has decreased in frequency and the aquatic flora appears to be stable. Given the improvement in floristic composition and water quality within the site it can be classified as being in **favourable condition**. Monitoring is recommended to ensure this status is maintained.

Table 54 Mallybreen Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Mallybreen Lough NI Lake 644	**Favourable**		Water chemistry data are favourable and show successive improvement since 1988. The flora, while not meeting all CSM targets is nonetheless typical of a shallow upland lake with brown water and is considered favourable.

Species list

Table 55 List of all plant species recorded at MallybreenLough

Marginal & Emergent species	**Abundance (DAFOR)**
Anagallis tenella	R
Calluna vulgaris	F
Carex echinata	R
Carex flacca	R
Carex nigra	R
Carex panicea	R
Carex pulicaris	R
Carex rostrata	F
Carex viridula subsp. *oedocarpa*	R
Drosera rotundifolia	R
Eleocharis multicaulis	R
Eleocharis palustris	R
Juncus articulatus	F
Menyanthes trifoliata	R
Molinia caerulea	F
Myrica gale	F
Narthecium ossifragum	R
Pellia epiphylla	R
Phragmites australis	R
Ranunculus flammula	R
Schoenus nigricans	R
Sphagnum sp.	O
Submerged & floating species	**% Frequency (n = 50)**
Chara virgata	4
Isoetes lacustris	22
Juncus bulbosus	20
Littorella uniflora	6
Lobelia dortmanna	16
Myriophyllum alterniflorum	44
Nitella flexilis agg.	20
Nuphar lutea	+
Nymphaea alba	20
Potamogeton natans	10
Potamogeton polygonifolius	+
Sparganium angustifolium	8
Sphagnums aquatic	4
Utricularia australis	12

Survey data

Site Condition Assessment: Mallybreen Lough (17/06/2015)

Lake Details		**Survey Details**		
Lake Name	Mallybreen Lough	Survey Date	17/06/2015	
SSSI Name		Surveyors	ES & JS	
SAC Name		Shore Surveys	2	out of
Grid Ref	H011660	Wader Surveys	2	2
WBID / NI No.	50551 / 644	Boat Surveys	2	sections

Site Notes:
Area of rough moorland grazing - relatively low intensity.

since

Survey Notes:
Sponges recorded and verified as Racekiela ryderii – frequent in Ireland, but no records in Fermanagh

1920 (Karen Evens, Liverpool)

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	120 cm
		Compass bearing of boat transect (°)	320 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Freshwater sponges present	
Section	**2**	Maximum depth of colonisation (cm)	140 cm
		Compass bearing of boat transect (°)	260 °
		Lateral distance from waters edge to 75cm depth (m)	4 m
		Notes: freshwater sponges present	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0105966097	H0104465980	H0103266046	H0109966029
Section	**2**	H0115766072	H0119965991	H0118466019	H0114065999

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3975	3974	3980
Section	**2**	3981	3982	3983

3.10. Fir Lough (MA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*.

Survey Date	30 August 2014
NI Lake Number:	645
WBID:	50618
County:	Fermanagh
Grid reference:	H013649
OS Grid reference (X,Y):	201328, 364870
Shoreline development index:	1.061
Surface area (ha.):	1.3
Maximum recorded depth (m):	1

Table 56 Condition Assessment Summary Table for Fir Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	**X**	1 present: *Sparganium angustifolium.* No *Littorella uniflora*, *Isoetes* spp. or *Lobelia dortmanna*
	Mesotrophic: ≥ 8 characteristic species	**X**	2 Broadleaf *Potamogeton* spp. (*P. alpinus* and *P. perfoliatus*) and *S. angustifolium*
	No loss of characteristic species	✓	No apparent loss since the 1988 survey.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	Only 28% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-native species present.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	**X**	0% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Zonation of *Littorelletea* species absent and remaining zones poorly defined. Fringing emergent vegetation patchy; dominant species include *Carex rostrata* (25-75 cm), *Equisetum fluviatile* (25-110 cm) and occasionally *Phragmites australis* (50->75 cm). *Caltha palustris* fairly common in shallow water of 25cm. Occasional *Nuphar lutea* (75-125 cm), with occasional *S. angustifolium* interspersed in depths 50-125 cm. *Chara virgata* (25-125 cm), *P. alpinus* (at 75 cm) and *P. perfoliatus* (at >75 cm) have very low abundance.
	Maximum depth distribution should be maintained	✓	Z_{max} = 1.25 m, Z_s = 1 m, Z_v = 1.25 m
	At least the present structure should be maintained	✓	No evidence of change.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 20 μgl^{-1}	**X**	TP = 30.5 μgl^{-1} (range 13-76.3) & TN = 0.6 mgl^{-1} (April '14 – Feb. '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.3 (range = 7.1 – 7.5). Favourable for mesotrophic.
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	✓	Waters were well mixed and oxygenated throughout the water column; mean value = 11.1 mgl^{-1}. No thermocline.
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Appears natural.
	Natural and characteristic substrate maintained	✓	Lake substrate predominantly silty.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓	Rough pasture in catchment and residential development, but no evidence of increased sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	✓?	None specified.
	Minimal negative impacts and no fish farming	?	Cesspit on landowners' property – no evidence of negative impact.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 1.3 ha and there is no evidence of any loss of extent of the open water.

Macrophyte community composition

Table 57 Aquatic macrophyte community composition for Fir Lough, including trophic scores

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=40)***
Chara virgata	8.5	7.69	**+**	8.5	7.69	17.5
Fontinalis antipyretica	6.3	5.38	5	6.3	5.38	60
Lemna minor	9.0	8.85	1	9.0	8.85	2.5
Nuphar lutea	8.5	6.92	1	8.5	6.92	50
Potamogeton alpinus	**5.5**	**5.38**	3	**5.5**	**5.38**	**10**
Potamogeton natans	6.7	4.23	1	-	-	-
Potamogeton obtusifolius	7.3	6.54	+	7.3	6.54	2.5
Potamogeton perfoliatus	**7.3**	**7.69**	3	**7.3**	**7.69**	**2.5**
Potamogton pusillus	8.5	7.95	3	-	-	-
Sparganium angustifolium	**3.0**	**4.23**	1	**3.0**	**4.23**	**17.5**
Average score	**7.1**	**6.33**		**6.9**	**6.59**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A "+" denotes a species found outside the survey sections.

Sparganium angustifolium was the only characteristic oligotrophic species at the site, with a distinct absence of *L. uniflora, Isoetes* spp. and *L. dortmanna*. Although two mesotrophic broad-leaved *Potamogeton* species were present, *P. alpinus* and *P. perfoliatus*, the standards for an Annex I type oligotrophic to mesotrophic standing water have not been met, as set by the CSM guidelines for this lake type (JNCC 2015). There has been no apparent loss in characteristic species since the 1988 NILS survey, since the species list was almost identical for 2014. *Chara virgata*, although not a characteristic species, is an additional record to the 1988 macrophyte

community. *Potamogeton natans* was recorded in 1988, but absent from the recent survey. Only 28% of the vegetated sample plots contained mesotrophic species. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 7.0 and 6.59 respectively (Table 56), which are similar to the 1988 TRS and PLEX scores of 7.1 and 6.33.

Negative indicator species

No non-native species were present at the time of survey. No filamentous algae cover scoring a '3' was recorded.

Macrophyte community structure

Fir Lough is bound by rough pasture and low growing herbs on all sides. To the northwest of the lough is a transitional wetland fringe associated with the inflow. A wetland dominated by reeds is also located to the southeast of the water body. The margin to the north side of the lough is dominated by *C. rostrata, Juncus effusus, C. palustris* and occasionally *Typha latifolia*. Fringing emergent vegetation is patchy, but comprises of *E. fluviatile,* at depths of 25 – 110 cm, with intermittent *P. australis*, at slightly shallower depths of 50 - >75 cm. *C. rostrata* was also found at depths of up to 75 cm. *N. lutea* was found infrequently at depths of 75 – 110 cm, becoming the dominant floating species up to depths of 125cm. *S. angustifolium* was recorded at depths of 50 – 125 cm, with an overall abundance of 2 (on a 1-5 scale). *P. alpinus* and *P. perfoliatus* were both recorded at a very low frequency, with an overall abundance of 1 at a depth of ~75 cm, while in the 1988 survey they were both recorded with an abundance of 3 (on a 1-5 scale). However, the survey methods used in 1988 and 2006 do not produce data that are directly comparable and so no firm conclusions can be drawn from the two sets of data concerning these two species. *Potamogeton pusillus* was recorded in moderate abundance in 1988, but was absent from the 2014 survey. *C. virgata* was an additional species however, occasionally observed in depths between 25 and 125 cm, with an overall frequency of 17.5%.

Water quality

The water chemistry of Fir Lough is typical for a low to moderate alkalinity lough within peat catchments. The site had circumneutral pH and peaty brown water, restricting the Secchi disc depth to approximately 1 m at the time of survey. Total phosphorus (30.5 μgl^{-1}) exceeds the target level set in the CSM guidelines for this lake type (20 μgl^{-1} JNCC 2015). Despite elevated P, the chlorophyll *a* concentrations remained low and are within the guidance target set for WFD (Carvalho *et al.* 2006). Currently Fir lough is unfavourable with respect to TP, but shows no immediate effects of nutrient enrichment (e.g. filamentous algae). The SRP value returned by the lab in November was 337 μgl^{-1} and was removed from the analysis.

Waters were oxygenated throughout the water column with a mean dissolved oxygen concentration of 11.1 mgl^{-1} (Figure 15). No thermocline was recorded.

Hydrology

The hydrology of the site appears natural. Fir Lough receives water from the northwest and drains to the southeast.

Lake substrate

The lake is without hard substrates and predominantly silty.

Table 58 Water chemistry data for Fir Lough
SRP for November 2014 erroneous

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	13.00	13.90	76.30	18.70	**30.48**	14
SRP	3.2	1.2	(337)	4.4	**2.9**	9
TN	0.43	0.67	1.16	0.32	**0.65**	0.98
TON	<0.005	0.030	0.034	0.86	**0.308**	-
Chl *a*	0.33	1.89	7.92	4.40	**3.63**	2.9
DOC	7.19	11.30	14.00	5.15	**9.41**	-
pH	7.41	7.49	7.08	7.13	**7.24**	7.55
Alk	40	44	34	15	**33**	16.7
Cond	125	123	101	119	**117**	166
Ca^{2+}	13.00	13.60	12.50	8.41	**15.15**	11.55
Mg^{2+}	2.50	2.81	3.60	2.22	**2.78**	3.7
Na^{+}	9.53	8.80	25.60	12.80	**10.91**	4.64
K^{+}	0.60	0.68	4.17	1.13	**1.65**	0.52
Cl^{-}	16.30	14.00	13.00	25.60	**17.23**	29.45
$SO4^{2-}$	<10	2.70	10.20	4.58	**6.87**	5.26

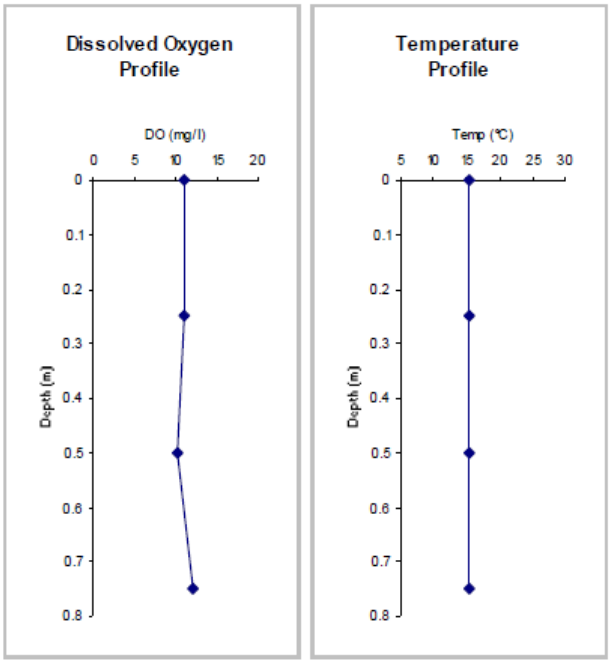
Figure 15 Dissolved oxygen and temperature profile for Fir Lough (30/08/2014)

Dissolved Oxygen Profile

GPS Location	H0133064845
Maximum Depth (m)	1 m
Secchi Depth (cm)	1 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	11.1	15.5
0.25	11	15.5
0.5	10.2	15.5
0.75	12.12	15.5



Sediment load
Although the lough is surrounded by rough pasture and is in close proximity of a small residential development, there is no evidence of increased sediment load.

Indicators of local distinctiveness
None specified.

Summary
Fir Lough is classified as an "oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*", but fails to achieve the necessary floristic requirement as defined within the CSM guidance (JNCC 2015) and is in **unfavourable condition** when assessed against oligo- and mesotrophic lough types. Although the characteristic oligotrophic species *S. angustifolium* and the mesotrophic characteristic species *P. alpinus* and *P. perfoliatus* were present, the site is without any of the more typical species (e.g. *L. uniflora, L. dortmanna* and *Isoetes lacustris*) and is too shallow to exhibit any zonation.

The site appears to have remained stable in terms of its flora since the NILS work with the species list generated in 2014 being almost identical to the 1988 list. The limited range of characteristic species, combined with their relatively low frequencies, meant that only 28% of vegetated plots contained the expected characteristic species for a mesotrophic site. The water chemistry of Fir Lough is typical for mesotrophic waters, having circumneutral pH, but TP concentrations exceed the target value. There was no evidence for sediment loading to the lough, despite it being surrounded by rough pasture and in close proximity to a recent residential development.

Fir Lough is classified as unfavourable, but in part its failure to fulfil the CSM targets are thought likely to being very shallow and having relatively high DOC (and brown water). Palaeoecological investigation would be worthwhile in order to assess site-specific baseline targets for both nutrients and macrophytes. Low grazing intensity should be maintained and sources of enrichment should be identified and managed appropriately.

Table 59 Fir Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Fir Lough NI Lake 645	**Unfavourable**	Only 1 characteristic oligotrophic sp. No *Littorelletea* spp. TP target exceeded	The site is very shallow and may not therefore be expected to support a full range of characteristic taxa. Site should be monitored for localised nutrient enrichment and low grazing intensity maintained. Site specific species and nutrient targets may help to better assess this lough.

Species list

Table 60 List of all plant species recorded at Fir Lough

Marginal & Emergent species	Abundance (DAFOR)
Carex rostrata	A
Nuphar lutea	F
Equisetum fluviatile	F
Caltha palustris	O
Potentilla palustris	O
Juncus effusus	O
Ranunculus flammula	O
Phragmites australis	O
Juncus acutiflorus	R
Typha latifolia	R
Senecio aquaticus	R
Menyanthes trifoliata	R
Lysimachia nummularia	R
Myosotis scorpioides	R
Galium palustre	R
Hydrocotyle vulgaris	R
Eleocharis palustris	R

Submerged & floating species	% Frequency (n = 74)
Chara virgata	18
Fontinalis antipyretica	60
Lemna minor	3
Nuphar lutea	50
Potamogeton alpinus	10
Potamogeton obtusifolius	3
Potamogeton perfoliatus	3
Sparganium angustifolium	18
Menyanthes trifoliata	+

Survey data

Site Condition Assessment: Fir Lough (30/08/2014)

Lake Details		**Survey Details**	
Lake Name	Fir Lough	Survey Date	30/08/2014
SSSI Name		Surveyors	SG, SD
SAC Name		Shore Surveys	1 out of
Grid Ref (centre)	H013649	Wader Surveys	1 1
WBID / NI No.	50618 / 645	Boat Surveys	1 sections

Site Notes:
Sess pit on owner's land

Survey Notes:

Section Summaries

Section 1	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	40 °
	Lateral distance from waters edge to 75cm depth (m)	-
	Notes: Colonised throughout lake	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H0139864867	H0131264923	H0136164902	H0132464869

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0477	0478	0479

3.11. Lough Rushen (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	17 June 2015
NI Lake Number:	646
WBID:	50064
County:	Fermanagh
Grid reference:	H019662
OS Grid reference (X,Y):	201938,366193
Shoreline development index:	1.684
Surface area (ha.):	23
Maximum recorded depth (m):	11.2

Table 61 Condition Assessment Summary Table for Lough Rushen

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	**Oligotrophic:** ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓	5 present: *Elatine hexandra, Isoetes lacustris, Littorella uniflora, Lobelia dortmanna* & *Sparganium angustifolium.*
	Mesotrophic: At least 8 characteristic species (JNCC 2015)	**X**	7 present: *Potamogeton alpinus, E. hexandra, I. lacustris, L. uniflora, L. dortmanna* & *Nitella flexilis* agg. & *S.angustifolium*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	Appears to have been shift in species composition (see text)
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	✓	89% of vegetated sample spots comply for mesotrophic species. 59% of vegetated sample spots comply for oligotrophic species (70% wader; 7% boat).
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	15% of sample points had a score of "3" for filamentous algae.
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Rough pasture / heathland surrounds lough. Wetland and emergent vegetation is naturally limited, but where present forms good stands (*Carex* spp., *Juncus* spp., *E. fluviatile, S. lacustris, P. australis & Salix* spp). Rocky E shore - no marginals except *L. uniflora* & open water dominated by *Littorelletea flora*. *C. virgata* & *Nitella flxilis* agg. common in open water to 2.4 m with *I. lacutris, L. uniflora, L. dortmanna* more common and generally restricted to <1.5 m.
	Maximum depth distribution should be maintained	✓	Zmax = 11.2 m, Zs = 2.4 m, Zv = 2.6 m.
	At least the present structure should be maintained	✓	Survey results similar to 2006
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	**X**	TP = 16.8 μgl^{-1} (range 12-27) & TN = 0.58 mgl^{-1} (Apr'14 – Feb'15). TP is unfavourable for both oligotrophic and mesotrophic
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.96 (range = 6.8 – 7.3).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	Waters well oxygenated: DO > 8.0 mgl^{-1} from 0 – 10 m.
	No excessive growth of cyanobacteria or green algae	✓	None noted
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Appears natural.

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	✓	Predominantly peat catchment. Sand or coarser mineral in shallows – occasional peat. Silts >50 cm and in open water.
Sediment load	Natural sediment load maintained	✓?	Some grazing observed, but minimal poaching.
Indicators of local distinctiveness	Distinctive elements maintained	✓	During survey lots of native crayfish and otter spraints (crayfish diet) observed.
	Minimal negative impacts and no fish farming	✓	Extent of grazing unknown, but some poaching observed. Minor shore angling?

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 23 ha, with no loss of extent of open water.

Macrophyte community composition

Two additional sections were conducted in 2015 and therefore the macrophyte data in this report are based on over double the number of sample points. Overall the flora in 2015 was comparable with that seen in 2006. There was a good coverage of isoetid species as well as a number of additional characteristic oligotrophic and mesotrophic taxa (Table 62). The additional transects were responsible for an increase in the frequency of Isoetids, which along with other characteristic oligotrophic taxa occurred in 59% of the vegetated plots; a slight improvement on the 2006 data and considered as favourable. *Nitella* spp. were less abundant than in 2006 and no *N. translucens* was recorded. *Potamogeton alpinus* was also less frequent and although noted at one other location outside of the sampling area, it was only recorded at one point in section 4 in 2015 compared to 6 points in section 2 in 2006. Although 89% of sample points had one or more characteristic mesotrophic species, only six species were present and therefore the site fails to meet the CSM target for mesotrophic sites (JNCC 2005 & 2015).

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 6.2 and 5.56 respectively, which compares well with the 2006 scores, but PLEX scores are higher than in 1988 when *Myriophyllum alterniflorum*, *Potamogeton gramineus*, *Potamogeton natans* and *Callitriche* spp. were also recorded (albeit at low abundance scores). *Sparganium emersum* was recorded in 2006, but with the lack of any flowering material it is possible this was incorrectly identified and was in fact *S. angustifolium. Nitella translucens and Potamogeton berchtoldii* were not recorded in 2015, but present in 2006. *Callitriche hamulata* was recorded in the strandline of section 2; this species was not recorded in 2009, but *Callitriche* spp. was present in 1988.

Negative indicator species

There were no negative indicator species present. Filamentous green algae was however as locally abundant with 15% of the survey points scoring “3” for algal cover (within the CSM threshold 20 %, JNCC 2015).

Table 62 Aquatic macrophyte community composition for Lough Rushen, including trophic scores.

Submerged and floating vegetation	2006 TRS	2006 PLEX	2006 % occurrence (n=53)*	2015 TRS	2015 PLEX	2015 % occurrence (n=118)*
Callitriche hamulata	-	-	-	5.0	6.15	+
Chara virgata	8.5	7.69	2	8.5	7.69	18
Elatine hexandra	**6.0**	**5.38**	**28**	**6.0**	**5.38**	**6**
Eleocharis acicularis	8.5	-	-	8.5	9.95	1
Fontinalis antipyretica	-	-	-	6.3	5.38	14
Glyceria fluitans	6.3	6.54	+	-	-	-
Isoetes lacustris	**5.0**	**4.23**	**34**	**5.0**	**4.23**	**46**
Juncus bulbosus	3.7	3.08	8	-	-	+
Littorella uniflora	**6.7**	**4.23**	**19**	**6.7**	**4.23**	**20**
Lobelia dortmanna	**5.0**	**3.08**	**36**	**5.0**	**3.08**	**33**
***Nitella flexilis* agg.**	**5.5**	**5.38**	**77**	**5.5**	**5.38**	**52**
Nitella translucens	**5.5**	**5.38**	**25**	-	-	-
Nuphar lutea	-	-	-	8.5	6.92	2
Potamogeton alpinus	**5.5**	**5.38**	**11**	**5.5**	**5.38**	**1**
Potamogeton berchtoldii	7.3	7.69	4	-	-	-
Potamogeton natans	-	-	-	6.7	4.23	10.2
Sparganium angustifolium	**-**	**-**	**?**	**3.0**	**4.23**	**+**
Sparganium emersum (?)	10.0	7.5	9	-	-	-
Average score	**6.4**	**5.46**		**6.2**	**5.56**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Lough Rushen is surrounded by heathland and rough heath grassland, with some some moderately improved grazing to the northeast. Much of the eastern shore lacks emergent vegetation, but there are stands of reed and emergent vegetation along much of the western and north shore (including *Carex lasiocarpa, C. rostrata*, *Juncus* spp.*, E. fluviatile, S. lacustris, P. australis* & *Salix* spp.). Within the open water, *Littorella uniflora* and *Lobelia dortmanna* are mostly restricted to quite shallow water (<1.0 m) and *Isoetes lacustris* only rarely extending into deeper water (maximum 2.2 m). *Elatine hexandra* was recorded in all sections, but at very low abundance and similarly *Chara virgata* was also distributed throughout the site, but only common (to 2.3 m) in section 1. *Nitella flexilis* agg. was the dominant species recorded in deeper water in all sections reaching a maximum depth of 2.6 m. *Potamogeton alpinus* was recorded at only one point in shallow water in section 4 and was absent from section 2 where in was recorded in 2006. The maximum depth of colonisation has increased from 2.0m in 2006 to 2.6 m in 2015. The water is brown and therefore limits the depth to which plants can grow. The current structure is considered favourable for a site of this type.

Water quality

The water chemistry of Lough Rushen is typical for an oligotrophic lough with some basic influence. The mean pH was circum-neutral and the ionic concentration relatively low (Table 63). Unlike the peatland lakes on the Pettigoe Plateau the water colour in the lough is much lighter brown and consequently light penetration is higher.

Table 63 Water chemistry data for Lough Rushen

	Apr'14	Aug '14	Nov '14	Feb'15	Mean	2006	1988
TP	14.5	11.9	26.8	13.8	**16.8**	25	23
SRP	2.3	<1.0	<1.0	2.8	**<1.8**	-	-
TN	0.38	0.70	0.66	0.57	**0.58**	0.46	0.98
TON	<0.005	0.060	0.187	0.138	**<0.10**	-	-
Nitrite	<0.001	0.002	<0.001	<0.001	**<0.001**	-	-
Chl *a*	2.1	0.9	4.1	1.4	**2.1**	5.5	2.9
DOC	6.21	6.50	7.53	6.72	**6.74**	-	-
pH	7.30	7.01	6.85	6.82	**6.96**	6.70	7.55
Alk	8	11	<5.00	<5.00	**<7.0**	17.4	0.6
Cond	74	74	68	77	**73**	64	166
Ca^{2+}	2.8	3.1	2.9	2.8	**2.9**	3.1	11.6
Mg^{2+}	1.4	1.6	1.3	1.6	**1.5**	1.5	3.7
Na^{+}	9.1	8.9	8.1	9.9	**9.0**	6.5	4.6
K^{+}	0.8	1.0	0.9	0.8	**0.9**	0.6	0.5
Cl^{-}	17.3	16.3	15.5	19.0	**17.0**	8.7	29.5
SO_4^{2-}	-	2.4	2.4	3.0	**2.6**	2.2	5.3

Total phosphorus concentrations were less variable than those seen in 2006 and the annual mean lower. The mean value of 16.8 μgl^{-1} exceeds the CSM limit for oligotrophic lakes (10 μgl^{-1}, JNCC 2015), but is within the guidelines for shallow mesotrophic lakes (20 μgl^{-1}, JNCC 2015) and given the apparent decline since 2006, is considered to be favourable for this site. Total and available nitrogen were relatively low within the site and oxidised nitrogen was probably the limiting nutrient in the lough during the growing season. Chl *a* concentrations were low throughout the year and although filamentous green algae was slightly above the CSM limit, there was no other evidence of nutrient enrichment. Other water quality parameters are consistent with the lake type (i.e. oligotrophic, LA VSh). The lake was well oxygenated at the time of survey (DO = 8.3-9.5 mgl^{-1} from 0-10 m water depth).

Hydrology

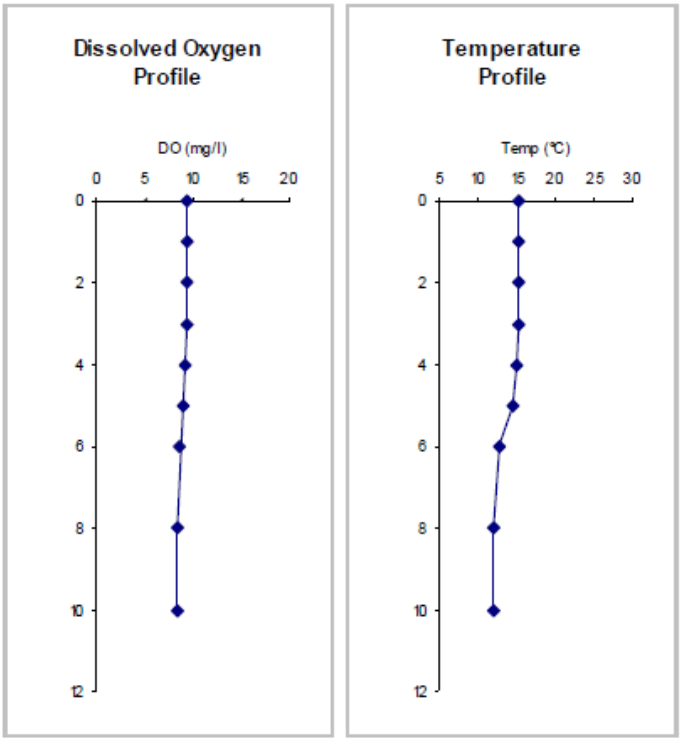
Lough Rushen has an inflow to the north and it drains to the east, the outflow stream passing through an area of marshland prior to joining the Crassowen River and eventually the Garvary River, which flows south, draining into Lower Lough Erne. The hydrological regime at the site appears natural.

Figure 16 Dissolved oxygen and temperature profile for Lough Rushen (17/06/2015)

Dissolved Oxygen Profile

GPS Location	H0195566156
Maximum Depth (m)	11 m
Secchi Depth (cm)	240 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	9.46	15.2
1	9.44	15.2
2	9.38	15.2
3	9.32	15.2
4	9.15	14.9
5	8.91	14.5
6	8.65	12.8
8	8.44	12.1
10	8.3	12



Lake substrate

The lake marginal substrates are rather mixed, predominantly comprising sands in the shallowest waters, with some areas of silt and occasional areas of peat and exposed bedrock. The open water substrates are silty.

Sediment load

Catchment land use is primarily low intensity grazing, and there was no evidence of any sediment in wash or increased sediment loads.

Indicators of local distinctiveness

Elatine hexandra is rare in Northern Ireland, and although there are historical records from nearby sites in Donegal (e.g. Bannus Lough, Forbes and Northridge, 2012) the only other previous records for Fermanagh are from the 2006 surveys (Goldsmith *et al.* 2008) from this site and nearby Loughs A Waddy and Vearty (the latter two also with confirmed records in 2014).

The remains and exuviae of native white-claw crayfish were noted in the site, as were otter spraints, some of which also contained crayfish remains.

Summary

Lough Rushen is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”. The lough contains good characteristic elements of both an oligotrophic and mesotrophic flora and shows no significant decline since the 2006 survey. There is some concern over the loss of *Potamogeton alpinus* at section 2, which although present elsewhere in the site would nonetheless benefit from further monitoring to assess the stability of

the population. The extent of the current flora is restricted by the moderately brown water of the lough which limits plants to approximately 2.5 m depth, but 59% of vegetated plots had one or more characteristic oligotrophic and 89% had mesotrophic species present. Although only having six characteristic mesotrophic species, the site has changed very little since the last survey and the current species assemblage is considered typical for the lake type and therefore favourable.

The water chemistry data indicate the lough to have improved since 2006 in terms of total phosphorus and now within favourable status for shallow mesotrophic waters. The TP exceeds the CSM limit for oligotrophic waters and therefore further monitoring is recommended to ensure conditions do not deteriorate. The current survey shows an improvement in water quality and a stable characteristic aquatic flora. Of possible concern is the presence of filamentous green algae and a reduction in the frequency of *P. alpinus.* The lough is therefore considered to be in **favourable condition (at risk)**.

Table 64 Lough Rushen: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Rushen NI Lake 646	**Favourable (at risk)**	Slightly elevated TP	Mean annual TP concentration with target levels for mesotrophic loughs, but exceed oligotrophic target. Characteristic aquatic flora remains stable since 2006. A reduction in *P. alpinus* and increase in filamentous algae suggest the site would benefit from further monitoring to assess possible impacts of nutrient enrichment.

Species list

Table 65 List of all plant species recorded at Lough Rushen

Marginal & Emergent species	Abundance (DAFOR)
Angelica sylvestris	R
Cardamine pratensis	R
Carex curta	R
Carex echinata	R
Carex flacca	R
Carex lasiocarpa	O
Carex nigra	R
Carex ovalis	R
Carex panicea	R
Carex rostrata	R
Carex viridula subsp. *oedocarpa*	R
Cerastium fontanum	R
Cirsium palustre	R
Cladium mariscus	R
Eleocharis palustris	R
Equisetum fluviatile	O
Filipendula ulmaria	R
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus articulatus	O
Juncus bulbosus	R
Juncus conglomeratus	R
Juncus effusus	O
Juncus squarrosus	R
Juncus subnodulosus	R
Liverworts unid	R
Luzula multiflora	R
Lychnis flos-cuculi	R
Molinia caerulea	R
Mosses unid	R
Myosotis secunda	R
Myrica gale	R
Pedicularis palustris	R
Pellia epiphylla	R
Phragmites australis	F
Polygala serpyllifolia	R
Polytrichum commune	R
Potentilla erecta	R
Potentilla palustris	R
Ranunculus flammula	R
Sagina procumbens	R
Salix sp.	R
Schoenoplectus lacustris	O
Sphagnum sp.	O

Submerged & floating species	% Frequency (n = 60)
Callitriche hamulata	+
Chara virgata	18
Elatine hexandra	6
Eleocharis acicularis	1
Fontinalis antipyretica	14
Isoetes lacustris	46
Littorella uniflora	20
Lobelia dortmanna	33
Nitella flexilis agg.	52
Nuphar lutea	2
Potamogeton alpinus	1
Potamogeton natans	10
Sparganium angustifolium	+

Survey data

Site Condition Assessment: Rushen Lough (17/06/2015)

Lake Details		**Survey Details**		
Lake Name	Rushen Lough	Survey Date	17/06/2015	
SSSI Name		Surveyors	ES, BG, JS	
SAC Name		Shore Surveys	4	out of
Grid Ref	H019662	Wader Surveys	4	4
WBID / NI No.	50064 / 646	Boat Surveys	4	sections

Site Notes:

clawed

Survey Notes:
4 sections completed - only 2 done in 2006. White-

crayfish remains seen.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	230 cm
		Compass bearing of boat transect (°)	310 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	210 cm
		Compass bearing of boat transect (°)	260 °
		Lateral distance from waters edge to 75cm depth (m)	7 m
		Notes:	
Section	**3**	Maximum depth of colonisation (cm)	220 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	8 m
		Notes:	
Section	**4**	Maximum depth of colonisation (cm)	260 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	6 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0184966381	H0179766281	H0181066331	H0184266316
Section	**2**	H0169666026	H0169465944	H0167965984	H0174565972
Section	**3**	H0220266481	H0222866395	H0223966446	H0218366420
Section	**4**	H0179866222	H0178166124	H0178766174	H0181766145

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3997	3996	3999
Section	**2**	3989	3988	3990
Section	**3**	3275	3276	3277
Section	**4**	3279	3280	3281

3.12. Lough Scolban (LA D)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea

Survey Date	28 August 2014
NI Lake Number:	647
WBID:	50014
County:	Fermanagh
Grid reference:	G995605
OS Grid reference (X,Y):	199620,360610
Shoreline development index:	2.223
Surface area (ha.):	64.25
Maximum recorded depth (m):	31.0

Table 66 Condition Assessment Summary Table for Lough Scolban

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species	✓	4 present: *Isoetes lacustris*, *Littorella uniflora, Lobelia dortmanna, Sparganium angustifolium*.
	Mesotrophic: 8 characteristic species present	✓	3 broadleaf *Potamogeton* spp. (*P. gramineus, P.* x *angustifolius, P. perfoliatus*) and *N. flexilis agg.* as well as those listed above

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	*P. alpinus, P. x nitens, B. ranunuloides* and *N. opaca* recorded in 2006 but not in 2014.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	63% of vegetated sample spots comply for mesotrophic species. (65.5% wader survey (3 transects) & 57.7% boat (3 transects)).
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded with 16.6% frequency (24% in 2006)
	Filamentous Algae (non-*Chara*):<20% of points scoring '3'	✓	1% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Grassy heathland, scrub and shrubs surround much of the lough, with some deciduous woodland to the SW & alder carr to the E/NE. Fringing emergent vegetation is patchy but consists of *Phragmites australis* (25-120 cm), *Schoenoplectus lacustris* (25-160 cm) and occasionally *Equisetum fluviatile* (25-50 cm, S2 only). Typical zonation of *Littorelletea* flora. Occasional *N. lutea* 25-180 cm in all sections. Interspersed with dominant *P. natans* in S2 (25-210 cm). *P. perfoliatus* recorded in greatest depths of 230 cm in S1. No plants beyond this depth.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 31 m, Z_s = 2.4 m, Z_v = 2.3 m.
	At least the present structure should be maintained	✓	No apparent change in structure.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} mesotrophic = 15 μgl^{-1}	**X**	TP = 16 μgl^{-1} (range 8-35) & TN = 0.67 mgl^{-1} (April '14 – Feb. '15). Unfavourable for oligotrophic and mesotrophic.
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.8 (range = 7.3 – 8.1).
	Adequate dissolved O_2 throughout the water column (mean > mgl^{-1} below thermocline)	✓	Waters well oxygenated through photic zone (DO >10 mgl^{-1} from 0–7 m, 9.3 mgl^{-1} at 10 m, dropping to 4.3 mgl^{-1} at 11m. Unable to measure DO beyond thermocline due to difficult weather conditions.

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	✓	None noted.
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	Predominantly peaty catchment, Marginal substrates mixed. Sands in the open water
Sediment load	Natural sediment load maintained	✓	No grazing or poaching was observed during survey – pasture in close proximity however. Impact unknown.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓?	Boat angling. Jetties to E. and road around lough. Residential development. Pasture to SW of lough, no grazing or poaching observed however.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 65 ha with no loss of extent to the open water.

Macrophyte community composition

Lough Scolban lies within a catchment of shallow peats and small areas of exposed bedrock. The water, although peaty brown, was clear enough during the survey to allow light penetration to 2.4 m, with the aquatic vegetation extending to a depth of 2.3 m. In 2014, a total of 46 macrophyte species were recorded from the lough, including 21 submerged and floating-leaved aquatics. The *Littorelletea flora*, which is often found in distinct zones in oligotrophic loughs, was present in Lough Scolban - characteristic species were *Isoetes lacustris, Littorella uniflora, Lobelia dortmanna* and *Sparganium angustifolium*. Four characteristic mesotrophic species were also recorded (*Nitella flexilis* agg. *Potamogeton gramineus, Potamogeton* x *angustifolius* and *Potamogeton perfoliatus*). Other submerged and floating-leaved species recorded from the lough at varying abundance were: *Chara aspera, , Chara virgata, Elodea canadensis, Fontinalis antipyretica, Myriophyllum alterniflorum, Nuphar lutea, Potamogeton berchtoldii, Potamogeton lucens, Potamogeton natans, Potamogeton obtusifolisus, Potamogeton pusillis* and *Ranunculus aquatilis* agg. The marginal emergent vegetation is dominated to the northwest by alder carr with patches of *Equisetum fluviatile*, *Juncus articulatus* and *Schoenoplectus lacustris* towards the open water. To the south, patches of fringing reeds grow along the margins (including *Phragmites australis* and *S. lacustris*) interspersed with *Juncus* spp. (predominantly *Juncus articulatus* and *Juncus effusus*), *Carex rostrata* and low growing herbs. The southern shoreline supports limited emergent vegetation due to deep shading from the deciduous woodland lying to the south.

Table 67 Aquatic macrophyte community composition for Lough Scolban, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=87)***	**TRS**	**PLEX**	**% occurrence (n=84)***
Baldellia ranunculoides	**4.0**	**-**	**7**	**-**	**-**	**-**
Chara aspera	8.5	7.69	34	8.5	7.69	4
Chara virgata	-	-	-	8.5	7.69	18
Chara virgata var. annulata	8.5	7.69	2	-	-	-
Chara virgata var. virgata	8.5	7.69	6	-	-	-
Elodea canadensis	8.5	7.95	24	8.5	7.95	17
Fontinalis antipyretica	6.3	5.38	21	6.3	5.38	15
Isoetes lacustris	**5.0**	**4.23**	**22**	**5.0**	**4.23**	**29**
Littorella uniflora	**6.7**	**4.23**	**59**	**6.7**	**4.23**	**17**
Juncus bulbosus	3.7	3.08	9	-	-	-
Lemna minor	9.0	8.85	+	-	-	-
Lobelia dortmanna	**5.0**	**3.08**	**28**	**5.0**	**3.08**	**10**
Mosses aquatic	-	-	1	-	-	-
Myriophyllum alterniflorum	5.5	4.23	40	5.5	4.23	29
Nitella flexilis agg.	**5.5**	**5.38**	**10**	**6.7**	**5.38**	**27**
Nitella opaca	**5.5**	**5.38**	**6**	**-**	**-**	**-**
Nuphar lutea	8.5	6.92	14	8.5	6.92	23
Potamogeton alpinus	**5.5**	**5.38**	**3**	**-**	**-**	**-**
Potamogeton berchtoldii	7.3	7.69	22	7.3	7.69	1
Potamogeton gramineus	**7.3**	**7.31**	**6**	**7.3**	**7.31**	**18**
Potamogeton gramineus x perfoliatus = P. x nitens	**-**	**7.69**	**+**	**-**	**-**	**-**
Potamogeton lucens x gramineus = P. x angustifolius	**-**	**7.69**	**24**	**-**	**7.69**	**4**
Potamogeton natans	6.7	4.23	+	6.7	4.23	21
Potamogeton obtusifolius	-	-	-	7.3	6.54	5
Potamogeton perfoliatus	**7.3**	**7.69**	**17**	**7.3**	**7.69**	**13**
Potamogeton pusillus	-	-	-	8.5	7.95	1
Ranunculus aquatilis agg.	-	-	-	8.5	7.95	1
Sparganium emersum	10.0	7.5	+	-	-	-
Sparganium angustifolium	**3.0**	**7.69**	**8**	**3.0**	**4.23**	**1**
Average score	**6.6**	**6.30**		**7.0**	**6.21**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 7.0 and 6.21 respectively (Table 67). This is very similar to the TRS and PLEX scores calculated from the 2006 data, suggesting that the trophic levels have remained stable over the past eight years. Three characteristic species were not recorded in 2014, but were noted in 2006: *P. alpinus, P. x nitens, B. ranunuloides* and *N. opaca.* This seems to have not impacted upon the calculated scores. A good coverage of characteristic species was found across the survey plots, where 63% of vegetated plots comprised of such species.

Negative indicator species

Elodea canadensis was recorded with a 16.6% total frequency. This is a decrease from 24%, as recorded in 2006. Although at relatively low frequency, the presence of this non-native species in unfavourable within CSM guidelines (JNCC2015). A moderate frequency of filamentous algae was recorded, with coverage of 15.7% in the wader survey points and 5.9% coverage in the boat transects.

Macrophyte community structure

Grassy heathland, scrub and shrubs surround the lough to all sides. The marginal emergent vegetation is variable in both nature and extent. There are areas of alder carr to the northeast and some deciduous woodland to the southwest. Patches of emergent vegetation towards the open water were recorded in all sections, consisting mainly of *P. australis* and *S. lacustris* in depths between 25 – 160 cm, with the occasional population of *E. fluviatile* in shallower depths of 25 – 50 cm, in section 2 only. Lough Scolban shows typical zonation of the *Littorelletea* flora. Occasional *N. lutea* was recorded between 25 – 180 cm in all sections, which was interspersed with *P. natans* in S2, dominant at depths of 25 – 210 cm. *P. perfoliatus* was recorded at the greatest depth of 230 cm in section 1, with no plants beyond this point. *M. alterniflorum* is common throughout the lough, appearing in all three sections in depths of 50 – 180 cm. *N. flexilis* was also recorded with a local abundance of “2” (on a 1-5 scale) within sections 1 and 3, at water depths of 25 – 180 cm. The current structure is considered favourable for a site of this type.

Water quality

The water chemistry of Lough Scolban is fairly typical for a mesotrophic lough, having a slightly alkaline pH (mean = 7.6) and low to moderate ionic concentrations. Unlike the dystrophic sites of the Garron Plateau the water colour in the lough is much lighter brown and consequently light penetration is higher. Total phosphorus concentrations are seasonally variable and the mean annual concentration is just above the target level set in the CSM guidelines for deep mesotrophic lake types (15 μgl^{-1}, JNCC 2015), however it is recognised that the interaction of nutrients in peaty sites is complex and therefore elevated TP is not always indicative of unfavourable conditions. Total nitrogen was low and although the lough shows limited direct evidence of the effects of nutrient enrichment, filamentous algae cover was moderate. Chl *a* concentrations were generally low. Other water quality parameters are consistent with the lake type (i.e. oligotrophic, LA D). The lough was well oxygenated throughout the photic zone at the time of survey in August 2014 (>10 mgl^{-1} from 0–7 m, 9.3 mgl^{-1} at 10 m and dropping to 4.3 mgl^{-1} at 11 m). A full DO profile of the 31m depth was not attainable on the day due to high winds and insufficient anchorage, therefore no comment can be made of the DO concentrations below the thermocline (Figure 17).

Table 68 Water chemistry data for Lough Scolban

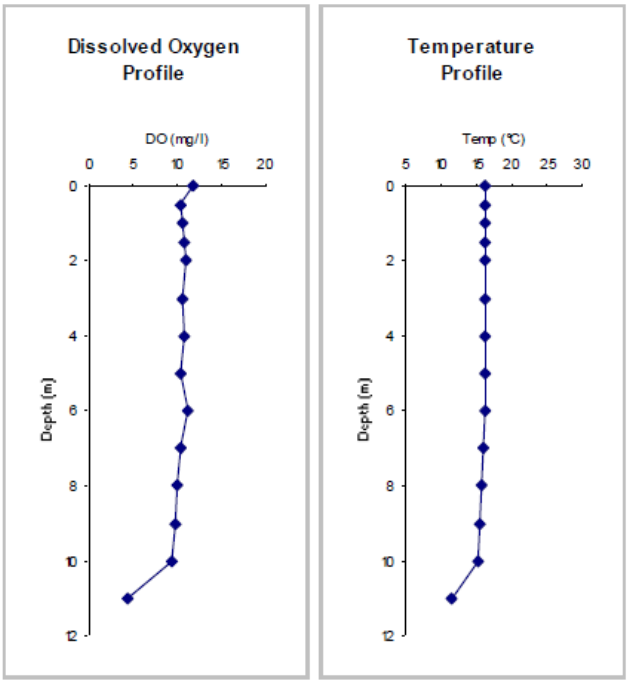
	Apr '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1988
TP	8.3	9.0	35.1	12.9	**16.3**	24.0	18.0
SRP	1.0	<1.0	<1.0	4.5	**1.8**	-	7
TN	0.53	0.55	0.89	0.72	**0.67**	0.55	0.4
TON	0.182	0.005	0.162	0.262	**0.152**	-	-
Chl *a*	0.99	3.74	2.48	0.39	**1.90**	4.90	3.79
DOC	6.56	6.25	8.73	7.81	**7.34**	-	-
pH	7.85	8.13	7.25	7.79	**7.63**	7.70	7.91
Alk	48	48	40	45	**45**	38	24.54
Cond	158	155	136	158	**152**	150	110
Ca^{2+}	19.00	18.60	15.60	17.30	**17.63**	21.70	22.1
Mg^{2+}	2.63	2.59	2.34	2.63	**2.55**	2.20	3.4
Na^{+}	10.40	10.10	9.67	11.10	**10.32**	8.30	2.6
K^{+}	1.07	1.06	1.72	1.21	**1.27**	1.10	1.04
Cl^{-}	20.2	18.8	18.5	20.8	**19.6**	9.7	27.6
$SO4^{2-}$	<10	4.70	5.89	6.10	**<6.67**	6.40	9.37

Figure 17 Dissolved oxygen and temperature profile for Lough Scolban (28/08/2014)

Dissolved Oxygen Profile

GPS Location	G9940760731
Maximum Depth (m)	12.1 m
Secchi Depth (cm)	240 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	11.77	16.3
0.5	10.45	16.3
1	10.61	16.3
1.5	10.74	16.3
2	11.01	16.3
3	10.51	16.3
4	10.82	16.3
5	10.44	16.3
6	11.21	16.2
7	10.33	16.1
8	9.99	15.8
9	9.78	15.6
10	9.3	15.3
11	4.3	11.6



Hydrology

Lough Scolban is a large lough fed by two main inflow streams (and associated feeder streams) which flow south off the Pettigoe Plateau. At its source the eastern stream flows through an area of coniferous forest. The western stream originates from the valley slopes between Breesy Hill and Croagh, passing over waterfalls before entering the lough. The lough drains to the east into the Garvary River via a short outflow. The Garvary River flows east/southeast for a short distance before entering Lower Lough Erne. The hydrological regime at the site appears natural.

Lake substrate

The lake margins are predominantly vegetated peat and silts, with occasional areas of exposed bedrock along the shoreline. The open water substrates are sandy.

Sediment load

The lough is surrounded by pasture, although no grazing was observed at the time of survey. No direct evidence of increased sediment load to the site.

Indicators of local distinctiveness

None specified.

Summary

Lough Scolban is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”. The lough does meet the floristic compositional targets defined within the CSM guidance (JNCC 2015), as it supports eight characteristic mesotrophic taxa (*P. gramineus, P.* x *angustifolium, P. perfoliatus*, *I. lacustris, L. uniflora, L. dortmanna, N. flexilis agg., S. angustifolium).* Four species which were recorded in 2006 were not seen in 2014 on the survey: *P. alpinus, P. x nitens, B. ranunuloides* and *N. opaca.* However, these species were recorded with a very low frequency in the previous survey so it is possible that they were simply not detected within the recent survey.

The lough’s overall macrophyte structure appears to be favourable. *E. canadensis* was recorded in the lough at a lower frequency than 2006, with a decrease of 7%. This currently is of low concern. Moderate levels of filamentous algae were recorded, although there does not appear to be any other evidence for nutrient enrichment. The lough’s annual TP levels are slightly higher than the feature type target. However, it is recognised that the interaction of nutrients in brown water sites is complex, therefore elevated TP may not be indicative of unfavourable conditions - this requires further investigation.

The Lough Scolban survey results place it in **Favourable condition**. It should be stressed however that several species that were not common in 2006 were not recorded and the TP data exceeds the CSM guidance but only by 1 μgl^{-1}. Data confidence is therefore low and we would recommend the site be surveyed again to clarify if there has been any deterioration at the site.

Table 69 Lough Scolban: Overview

Water Body	Status	Reason(s) for concern	Comments
Lough Scolban NI Lake 647	**Favourable (at risk)**	Mean TP just exceeds the upper limit for mesotrophic waters. Several taxa present in the 2006 survey not recorded in this survey.	Good example of a floristically rich mesotrophic lough. TP is slightly above target levels, suggesting enrichment, but peaty water may affect TP / trophic status relationship. Filamentous algae moderate. Other evidence of enrichment limited. Frequency of *E. canadensis* has decreased since 2006. The site is borderline and it is recommended that it be surveyed again within 3 years to confirm the assessment.

Species list

Table 70 List of all plant species recorded at Lough Scolban

Marginal & Emergent species	Abundance (DAFOR)
Juncus articulatus	F
Mentha sp.	F
Schoenoplectus lacustris	F
Filipendula ulmaria	O
Alnus glutinosa	O
Potentilla anserina	O
Potamogeton perfoliatus	O
Phragmites australis	O
Eleocharis palustris	O
Galium palustre	R
Senecio aquaticus	R
Equisetum fluviatile	R
Juncus effusus	R
Carex rostrata	R
Salix sp.	R
Succisa pratensis	R
Equisetum palustre	R
Juncus inflexus	R
Phalaris arundinacea	R
Iris pseudacorus	R
Caltha palustris	R
Ranunculus flammula	R
Calluna vulgaris	R
Angelica sylvestris	R
Juncus conglomeratus	R
Hydrocotyle vulgaris	R
Alisma plantago-aquatica	R
Lysimachia nummularia	R
Carex nigra	R
Epilobium palustre	R

Submerged & floating species	% Frequency (n = 84)
Chara aspera	4
Chara virgata var. *virgata*	18
Elodea canadensis	17
Fontinalis antipyretica	15
Isoetes lacustris	29
Littorella uniflora	17
Lobelia dortmanna	10
Myriophyllum alterniflorum	29
Nitella flexilis agg.	27
Nuphar lutea	23
Potamogeton berchtoldii	1
Potamogeton gramineus	18
Potamogeton lucens	4
P. x *angustifolius*	4
Potamogeton natans	21
Potamogeton obtusifolius	5
Potamogeton perfoliatus	13
Potamogeton pusillus	1
Ranunculus aquatilis agg.	1
Sparganium angustifolium	1

Survey data

Site Condition Assessment: Scolban Lough (28/08/2014)

Lake Details		**Survey Details**		
Lake Name	Scolban Lough	Survey Date	28/08/2014	
SSSI Name		Surveyors	SG, ST	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	G996606	Wader Surveys	3	3
WBID / NI No.	50014 / 647	Boat Surveys	3	sections

Site Notes:

Survey Notes:

Section Summaries

Section 1

Maximum depth of colonisation (cm)	230 cm
Compass bearing of boat transect (°)	140 °
Lateral distance from waters edge to 75cm depth (m)	10 m

Notes: Blue-green algae present at banks

Section 2

Maximum depth of colonisation (cm)	220 cm
Compass bearing of boat transect (°)	250 °
Lateral distance from waters edge to 75cm depth (m)	10 m

Notes:

Section 3

Maximum depth of colonisation (cm)	200 cm
Compass bearing of boat transect (°)	130 °
Lateral distance from waters edge to 75cm depth (m)	3 m

Notes: Short boat transect due to steep littoral zone

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	G9946160111	G9954160171	G9951061025	-
Section 2	G9881260145	G9877860275	G9878260207	G9879460218
Section 3	G9961660739	G9966860828	G99611160792	G9960960781

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0436	0438	0439
Section 2	440	-	0442
Section 3	-	-	-

3.13. Nafeola Lough (Peat, VSh)

Annex 1 type: H3160: Natural dystrophic lakes and ponds (changed from Isoetid)

Survey Date	26 August 2014
NI Lake Number:	654
WBID:	50646
County:	Fermanagh
Grid reference:	H032645
OS Grid reference (X,Y):	203199,364486
Shoreline development index:	1.119
Surface area (ha.):	1.2
Maximum recorded depth (m):	5.5 m

Table 71 Condition Assessment Summary Table for Nafeola Lough.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Dystrophic: No loss of characteristic species listed	✓	6 characteristic species present: *N. alba, Sphagnum sp., U.minor*, *M. trifoliata*, *S. angustifolium* & *P.polygonifolius.*
	No loss of characteristic species	✓	No loss of characteristic species since the 2006 survey, although several non-characteristic aquatic species present in 2006 are absent from this survey; including the nationally rare *Nitella confervacea*. Only one transect performed in this survey which did not match the locations of the 2007 survey.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	✓	None recorded.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	0% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Margins with *Myrica*, *Calluna* & *Erica* rough grass heathland / pasture. Fringing emergent vegetation (*P. australis*, *C. rostrata* & *C. limosa*) and *Juncus* spp.) mainly along E margins to ~75 cm. Patches of *N. alba* upto >75cm plots. *N. translucens* present up to 1m depth. And *Sphagnum sp.* and *U. minor* present at various depths <1m. *P. natans* and *P. polygonifolius* recorded on site but not within the transect section. Absence of *P. alpinus*, *P. birchtoldii* and *N. confervacea* may reflect true absence or the change in transect locations from 2007. The 2007 survey was also performed in June whereas the current survey was performed in late August, so temporal variation in species composition may also account for the differences.
	Maximum depth distribution should be maintained	✓	Z_{max} = 5.5 m, Z_s = 0.95 m, Z_v = 1 m.
	At least the present structure should be maintained	**X?**	Z_s and Z_y both greater in 2006. Z_{max} similar.
Water quality	Stable nutrients levels: TP target / limit 10 µgl-1	✓**?**	TP = 12.7 μgl^{-1} (range 6-20) & TN = 0.45 mgl^{-1} (Apr '14 – Feb '15). As in 2006 just exceeding the dystrophic target
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.46 (range = 5.5 – 6.7).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	✓	Waters well oxygenated: Mean DO = 8.34 mgl^{-1} throughout the water column. Windy day probably caused mixing of the water column.
	No excessive growth of cyanobacteria or green algae	✓	None present

Attribute	Target	Status	Comment
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of peat and silt
Sediment load	Natural sediment load maintained	✓	The lough sits within a catchment consisting of forestry and rough pasture. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	**X?**	*Nitella confervacea* recorded in 2007. Not recorded in 2014, possibly missed due to different transect location?
	Minimal negative impacts and no fish farming	**✓?**	Grazing cattle present at the time of survey. Very low stocking rates however.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.2 ha, with no loss of extent of open water.

Macrophyte community composition

Lough Nafeola is shallow and lies within a peat dominated catchment and has moderately brown water. It was originally classified as an Annex I type oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea, but the water quality, catchment characters and flora are more consistent with it being “dystrophic” and therefore it was re-classified in 2007. The margins are dominated by *Myrica gale* and mixed heath community including *Calluna vulgaris, Eriophorum angustifolium, E. vaginatum* and *Juncus* spp., on the dryer bank tops, with *Carex rostrata, C. limosa, Phragmites australis, Potentilla palustre* and *Sphagnum spp*. growing in damper areas and as emergents. A total of ten submerged and floating leaved macrophyte species were recorded from Lough Nafeola in August 2014 including six characteristic dystrophic species: *J. bulbosus, N. alba: P. polygonifolius, M. trifoliata, S. angustifolium* & aquatic *Sphagnum sp*. In addition *P. natans, N. translucens, U. minor* and other aquatic mosses were also recorded. The macrophyte assemblage is considered to be consistent with that expected for a species-rich dystrophic site.

There are some differences between the aquatic taxa recorded in this survey compared with the 2007 survey. Although the list of characteristic species is the same, 3 notable species are missing from the list. *Potamogeton birchtoldii*, *Potamogeton alpinus* and the nationally rare *Nitella confervacea* were recorded in 2007 but not in 2014. Due to an administrative error the transects performed in 2014 were not in the same locations as those performed in 2007. This could account for the different taxa lists, also the surveys were performed in different months, the 2006 survey in June and the 2014 survey in late August. By late August some macrophytes begin to die off, which could be the case for the two missing *Potamogeton* species. Most charophytes are perennial however so the absence of

N. confervacea could reflect survey error. An additional survey should be performed to confirm the presence or absence of *N. confervacea*.

Utricularia minor was recorded for the first time since the NILS 1988 survey, suggesting that it was probably missed in the 2007 survey.

Table 72 Aquatic macrophyte community composition for Nafeola Lough, including trophic scores

	2007			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=52)***	**TRS**	**PLEX**	**% occurrence (n=23)***
Batrachospermum sp.	-	-	-	-	-	4.3
Fontinalis antipyretica	6.3	5.38	35	-		
Juncus bulbosus	**3.7**	**3.08**	**27**	**3.7**	**3.08**	**60.9**
Menyanthes trifoliata	**5.3**	**-**	**8**	**5.3**	**-**	**+**
Mosses aquatic	-	-	12	-	-	4.3
Nitella confervacea	5.5	5.38	13	-	-	
Nitella translucens	5.5	5.38	44	5.5	5.38	43.5
Nuphar lutea	8.5	6.92	8	-	-	
Nymphaea alba	**6.7**	**3.08**	**23**	**6.7**	**3.08**	**21.7**
Potamogeton alpinus	5.5	5.38	2	-	-	
Potamogeton berchtoldii	7.3	7.69	2	-	-	
Potamogeton natans	6.7	4.23	33	6.7	4.23	+
Potamogeton polygonifolius	**3.0**	**3.08**	**+**	**3.0**	**3.08**	**+**
Sparganium angustifolium	**3.0**	**4.23**	**2**	**3.0**	**4.23**	**+**
Sphagnum sp.	**3.7**	**1.54**	**46**	**3.7**	**1.54**	**13**
Utricularia minor	**-**	**-**	**-**	**4.0**	**3.08**	**17.4**
Average score	**5.4**	**4.61**		**4.6**	**3.46**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Negative indicator species

None recorded

Macrophyte community structure

Margins with *Myrica, Calluna* & *Erica* rough grass heathland / pasture. Fringing emergent vegetation (*P. australis, C. rostrata* & *C. limosa* and *Juncus* spp.) mainly along E margins to ~75 cm. Patches of *N. alba* upto >75cm plots. *N. translucens* present up to 1m depth. And *Sphagnum* sp. and *U. minor* present at various depths <1m. *P. natans* and *P. polygonifolius* recorded on site but not within the transect section. Absence of *P. alpinus*, *P. berchtoldii* and *N. confervacea* may reflect true absence or the change in transect locations from 2007. The 2007 survey was also performed in June whereas the current survey was performed in late August, so temporal variation in species composition may also account for the differences.

Water quality

Table 73 Water chemistry data for Nafeola Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	2007	1988
TP	9.7	15.7	5.9	19.6	**12.7**	13	26
SRP	1.3	<1	1.3	<1	**<1.2**	-	11
TN	0.36	0.65	0.57	0.31	**0.47**	0.9	0.92
TON	0.03	0.007	0.049	0.021	**0.027**	-	-
Nitrite	0.002	<0.001	<0.001	<0.001	**<0.001**	-	-
Chl a	0.9	2.36	1.54	0.8	**1.40**	3.5	20.1
DOC	6.76	12.1	12.3	5.2	**9.09**	-	-
pH	69	85	54	96	**76**	5.7	6.55
Alk	<5.00	23	8	<5.00	**<10.3**	3.1	7.0
Cond	69	85	54	96	**76**	62	132
Ca2+	1.9	6.86	1.86	1.45	**3.02**	2.4	8.5
Mg2+	1.32	2.12	1.06	1.91	**1.6**	7.3	2.8
Na+	9.77	8.32	7.13	13.3	**9.63**	7.2	14.65
K+	0.514	0.187	0.376	0.448	**0.381**	0.6	0.15
Cl-	18	13.9	12.6	26.3	**17.7**	8.8	30.04
SO42-	<10	2.81	2.22	4.18	**<4.80**	4	6.31

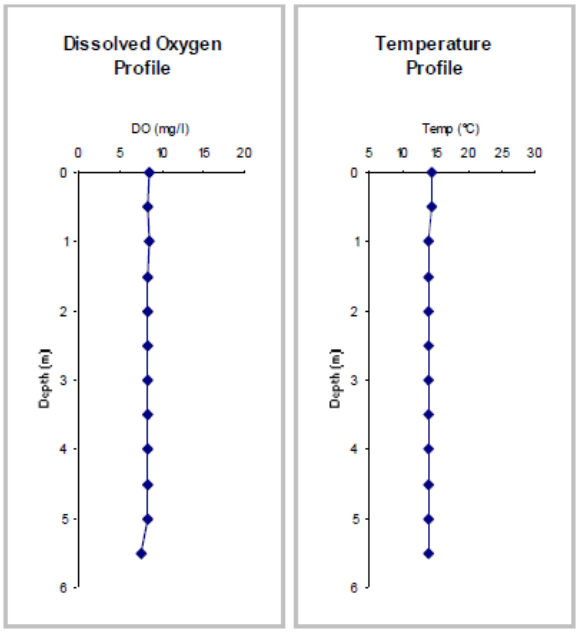
Figure 18 Dissolved oxygen and temperature profile for Nafeola Lough (26/08/2014)

Site Condition Assesment: Nafeola Lough (26/08/2014)

Dissolved Oxygen Profile

GPS Location NV1517931138
Maximum Depth (m) 5.5 m
Secchi Depth (cm) 95 cm
Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	8.57	14.4
0.5	8.44	14.5
1	8.45	14.1
1.5	8.42	14
2	8.41	14
2.5	8.39	14
3	8.38	14
3.5	8.38	14
4	8.37	14
4.5	8.3	14
5	8.32	14
5.5	7.66	13.9



The water chemistry of Lough Nafeola is not entirely consistent with a dystrophic water body. The mean pH is above 5.5 suggesting possible base enrichment. Total phosphorus is only just above the target level set in the CSM guidelines for this lake

type (10 µgl-1 JNCC 2015), however it is recognised that the interaction of nutrients in peaty sites is complex and therefore elevated TP is not always indicative of unfavourable conditions. Furthermore, there is no direct or indirect evidence to suggest that the lough has elevated nutrient concentrations (i.e. filamentous algal cover and Chl a concentrations are low). The lake was well oxygenated at the time of survey (mean DO was 8.34 mgl^{-1} throughout the water column on a very windy day).

Hydrology
Lough Nafeola has no discernable inflow stream. It drains to the south through an area of coniferous woodland before converging with the outflow from Tullynaloob Lough and continuing to flow south, eventually draining into Lower Lough Erne. The hydrological regime at the site appears natural.

Lake substrate
The lake margins are predominantly vegetated peat and silts. The open water substrates are organically enriched silts with areas of leaf litter and woody debris (the latter substrate being favoured by *Nitella confervacea*).

Sediment load
There was no direct or indirect evidence of increased sediment loads to the site at the time of survey. Cattle were observed grazing within 200m of the lough at the time of the survey although the stocking rate was very low (~6 cattle seen)

Indicators of local distinctiveness
None previously specified until the 2007 survey when the Nationally Rare stonewort species, *Nitella confervacea* was recorded, growing on both peaty and silty substrates at water depths of between 75 and 160 cm. This species is rare and has only been recorded from a few water bodies in NI – from the Lough Navar Forest to the south of Lower Lough Erne and from one site in Donegal (Republic of Ireland). A targeted survey should confirm whether it is still present at the site.

Summary
Based on the flora and very brown (humic) water, Nafeola Lough has been assessed against dystrophic targets rather than oligotrophic as originally classified. The justification for this is based on the site location with extensive peat catchment and on passed and present survey data.

Nafeola lough is in a smiliar condition to the last survey performed in 2007. Although some differences were observed such as an absence of several *Potamogeton* species and the rare *Nitella confervacea*. This is likely to be due in part to an altered transect location and the survey being performed late in summer. Given its rarity, the status of this charaphyte should be checked by performing a targeted survey in the areas where it was found in 2007. The lough continues to support 6 characteristic dystrophic species. TP is slightly above target levels for a dystrophic lough, however this is probably not of concern given the brown waters of the lough and its possible interaction with nutrient concentrations. Lough Nafeola is considered to be in **favourable condition** under the CSM guidelines for dystrophic sites (JNCC 2015).

Table 74 Nafeola Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Nafeola Lough NI Lake 654	**Favourable**		A species rich brown-water site. *N. confervacea* (Nationally Rare), was recorded in 2007 but not in 2014.

Species list

Table 75 List of all plant species recorded at Nafeola Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Calluna vulgaris	O
Caltha palustris	R
Carex elata	R
Carex nigra	O
Carex rostrata	A
Carex sp.	O
Drosera rotundifolia	R
Eleocharis multicaulis	R
Eleocharis palustris	R
Eriophorum angustifolium	R
Galium palustre	R
Juncus articulatus	R
Juncus effusus	O
Menyanthes trifoliata	O
Molinia caerulea	F
Narthecium ossifragum	O
Nymphaea alba	A
Phragmites australis	F
Polytrichum commune	R
Potentilla erecta	R
Potentilla palustris	R
Ranunculus flammula	R
Sphagnum sp.	F
Succisa pratensis	R
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 23)**
Batrachospermum sp.	4
Juncus bulbosus	61
Menyanthes trifoliata	+
Moses aquatic	4
Nitella translucens	44
Nymphaea alba	22
Potamogeton natans	+
Potamogeton polygonifolius	+
Sparganium angustifolium	+
Sphagnum sp.	13
Utricularia minor	17

Survey data

Site Condition Assessment: Nafeola Lough (26/08/2014)

Lake Details		**Survey Details**		
Lake Name	Nafeola Lough	Survey Date	26/08/2014	
SSSI Name		Surveyors	ES & GC	
SAC Name		Shore Surveys	1	out of
Grid Ref (centre)	H032645	Wader Surveys	1	1
WBID / NI No.	50646 / 654	Boat Surveys	1	sections

Site
same

Survey
V. small site, Sheep grazing nearby. Transect not the location as the 2007 survey.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	100 cm
	Compass bearing of boat transect (°)	300 °
	Lateral distance from waters edge to 75cm depth (m)	-
	Notes: Ewans Camera & GPS	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end
Section 1	H0324764524	H0324664462	H0326764507	H0322964493

Section Photos

	Start of Section		Whole Section	End of Section
Section	**1**	2515	2516/21	2517

3.14. Lough A Waddy 657 (LA VSh)

Photo: Ewan Shilland

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	26 August 2014
NI Lake Number:	657
WBID:	50159
County:	Fermanagh
Grid reference:	H042650
OS Grid reference (X,Y):	204111,364977
Shoreline development index:	1.194
Surface area (ha.):	8.5
Maximum recorded depth (m):	2.6

Table 76 Condition Assessment Summary Table for Lough A Waddy

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species	✓	3 present: *Isoetes lacustris, Littorella uniflora, Lobelia dortmanna.* Also two other characteristic species: *Elatine hexandra* & *Sparganium angustifolium.*
	Mesotrophic: ≥ 8 characteristic species	**X**	All of the above, plus *Nitella flexilis* agg.
	No loss of characteristic species	✓	No loss of characteristics. Gain of *N. flexilis* agg.
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	✓	90% of vegetated sample spots comply for oligotrophic species. (93% wader survey & 86% boat survey)
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous Algae (non-*Chara):* <20% of points scoring '3'	**X**	High filamentous algae recorded: 30% of sampling points have cover values of 3 (boat and wader survey combined).

Attribute	Target	Status	Comment
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Marginal vegetation is dominated by *Juncus* spp. (*J. articulatus, J. acutifloris, J. effusus*), *Calluna vulgaris, Molinia caerulea* and *Carex* spp. Within the open water, *L. uniflora* and *E. hexandra* (S3) sparse to 50 cm, *L. dortmanna* common to 75 cm and beyond this *I. lacustris* was dominant to a max recorded depth of 130 cm. Occasional patches of *P. natans* and *E. fluviatile* (50-100 cm).
	Maximum depth distribution should be maintained	✓**?**	Z_{max} = 2.6 m, Z_s = 0.38 m, Z_v = 1.5 m.
	At least the present structure should be maintained	✓	Well defined hydroseres between the Isoetes – Littorella communities, with vegetation margins (see above) that have been stable since the 2006 survey.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 20 μgl^{-1}	**X**	TP = 12.3 μgl^{-1} (range 8.4 – 17.1) & TN = 0.5 mgl^{-1} (April '14 – Feb'15). Favourable for mesotrophic
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 5.5 (range = 4.3 – 6.5).
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	✓	Waters well oxygenated and mixed: DO = 10 – 9.6 mgl^{-1} from 0 – 2 m.
	No excessive growth of cyanobacteria or green algae	✓	Not present.
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	Predominantly peat catchment. Mixed coarse to fine mineral substrates in margins. Sand predominant at depth in S1 and S2. Silty substrates in the open water of S3.
Sediment load	Natural sediment load maintained	✓	No grazing / poaching observed. Coniferous plantations to N & S.
Indicators of local distinctiveness	Distinctive elements maintained	✓	*E. hexandra* was first recorded in Lough A Waddy in 2006 and is a rare species in Northern Ireland. It has been recorded in the 2014 survey in S3.

Attribute	Target	Status	Comment
	Minimal negative impacts and no fish farming	✓	No grazing or poaching seen. Coniferous plantation N and S of lake.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 8.5 ha with no loss of extent to the open water.

Macrophyte community composition

Table 77 Aquatic macrophyte community composition for Lough A Waddy, including trophic scores

	2007			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=60)***	**TRS**	**PLEX**	**% occurrence (n=83)***
Elatine hexandra	**6.0**	**5.38**	28	**6.0**	**5.38**	**7.23**
Fontinalis antipyretica	6.3	5.38	22	6.3	5.38	18.07
Isoetes lacustris	**5.0**	**4.23**	83	**5.0**	**4.23**	**72.29**
Juncus bulbosus	3.7	3.08	20	3.7	3.08	12.05
Littorella uniflora	**6.7**	**4.23**	25	**6.7**	**4.23**	**10.84**
Lobelia dortmanna	**5.0**	**3.08**	65	**5.0**	**3.08**	**53.01**
Myriophyllum alterniflorum	5.5	4.23	8	5.5	4.23	20.48
Nitella flexilis agg.	**-**	**-**	-	**5.5**	**5.38**	**6.02**
Potamogeton natans	6.7	4.23	10	6.7	4.23	7.23
Potamogeton polygonifolius	3.0	3.08	+	3.0	3.08	2.41
Sparganium angustifolium	**3.0**	**4.23**	12	**3.0**	**4.23**	**1.2**
Sphagnum sp.	-	-	-	3.7	1.54	24.1
Average score	**5.1**	**4.12**		**5.0**	**4.01**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Five characteristic oligotrophic species were recorded: *Elatine hexandra, Isoetes lacustris, Littorella uniflora, Lobelia dortmanna* and *Sparganium angustifolium*, plus one mesotrophic species, *Nitella flexilis*. 90% of vegetated sample spots had ≥ 1 characteristic species (93% wader and 86% boat), therefore achieving the favourable condition target for characteristic species composition. Other submerged and floating-leaved aquatic macrophyte species present in the lough were *Fontinalis antipyretica, Juncus bulbosus, Myriophyllum alterniflorum, Potamogeton natans* and *Potamogeton polygonifolius*. Marginal emergent vegetation around the lough was largely low growing, comprising predominantly *Juncus* spp. (*Juncus articulatus, Juncus acutifloris* and *Juncus effusus*), *Sphagnum* spp. and *Carex* spp. Occasional patches of *Equisetum fluviatile* were also recorded.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan et al. 2006) of the site were 5.0 and 4.01 respectively (Table 77). The scores calculated from the 2006 survey data (5.1 and 4.12 respectively) are extremely similar and suggest that there has been little change in trophic status of the lough over that period. Furthermore, examination of the 2006 and 2014 species lists shows minimal change in species composition. The most significant difference is the appearance of *Nitella flexilis* agg. in the 2014 survey. Species composition is also almost identical to that recorded in the 1988 survey, demonstrating that the lacustrine plant communities have changed very little over 26 years.

Negative indicator species

No alien or nuisance species were recorded from the site. However filamentous algae cover scores were quite high, with 30% of all sampling points having a cover value of 3, suggesting slight nutrient enrichment.

Macrophyte community structure

Heathland dominated by *Calluna vulgaris, Molinia caerulea* and *Myrica gale* surrounds the lough to the west and east, with coniferous forest lying to the north and south. Peat hags extend to the shore along the western margins (S1) and there is a sandy beach to the east. The water was slightly turbid, giving a secchi depth reading of only 0.38 m in S1 and S2, improving in S3 with 1.1 m. Despite this, plants were recorded to depths of 1.5 m. The *Littorelletea* flora, which is often found in distinct zones in oligotrophic loughs was present and showed the typical zonation pattern in Lough A Waddy across all survey sections, growing on different substrates. The abundance of *L. uniflora* was rather sparse, growing in shallow water to a depth of ~0.5 m. *E. hexandra* was present in slightly deeper waters of 1.5 m, only in S3. *L. dortmanna* was abundant to a depth of 0.75 m and *I. lacustris* to 1.3 m. *Nitella flexilis* agg. was abundant in S1 only, to depths of 1.1 m. The marginal emergent vegetation was generally low growing, with occasional patches of reeds extending into slightly deeper water on suitable substrate. *Fontinalis antipyretica* was frequent in S3, being particularly abundant at water depths of 75-90 cm. Occasional patches of *P. natans, S. angustifolium* and *E. fluviatile* were recorded growing mainly to the west and east (S1 and S2) at water depths of 0.75-1.1 m. No aquatic plants were recorded growing beyond a water depth of 1.5 m. The current structure is considered favourable for a site of this type. An additional section was added to the 2014 survey, on the northern side of the lough which lies in Northern Ireland, which was not surveyed in 2006 (S3).

Water quality

The water chemistry of Lough A Waddy is typical for an oligotrophic lough, having a slightly acidic pH and low ionic concentration. The lough's water colour is peaty brown, allowing light penetration to 1.1 m at the time of survey. Total phosphorus (12.3 μgl^{-1}) is slightly above the target level set in the CSM guidelines for an oligotrophic lake (10 μgl^{-1} JNCC 2015), but is within the limit for a mesotrophic lake (20 μgl^{-1} JNCC 2015). It is recognised that the interaction of nutrients in peaty sites is complex and therefore elevated TP is not always indicative of unfavourable conditions. Total nitrogen was low although the lough shows slight evidence of the effects of nutrient enrichment: filamentous algae cover is fairly high, yet Chl *a* concentrations are low. In 2006, a relatively high abundance of *J. bulbosus* and *F. antipyretica* was reported along the sandy shoreline to the east (S2). The recent

survey recorded only a low frequency of *J. bulbosus* and no *F. antipyretica.* At the time of survey in August 2014 the lake was well oxygenated and mixed (DO from 0 – 2 m was 10 – 9.6 mgl^{-1}).

Table 78 Water chemistry data for Lough A Waddy

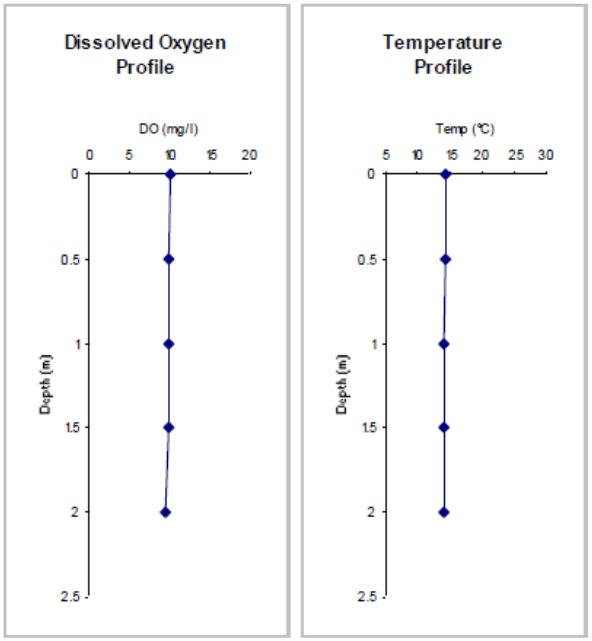
	Apr '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1988
TP	13.70	8.40	17.10	10.00	**12.30**	19.00	11.00
SRP	2.6	<1.0	3.5	1.9	**2.3**	-	5
TN	0.37	0.46	0.82	0.34	**0.50**	0.83	0.23
TON	<0.005	0.01	0.02	0.02	**0.01**	-	-
Nitrite	0.00	<0.001	<0.001	<0.001	**0.00**	-	-
Chl *a*	1.87	1.21	1.47	3.19	**1.93**	5.50	2.30
DOC	6.46	11.50	30.00	7.98	**13.99**	-	-
pH	6.26	6.46	4.25	4.95	**4.77**	5.50	7.14
Alk	<5	6	<5.00	<5.00	**<5.25**	5.00	2.70
Cond	72	62	96	88	**79**	63	130
Ca^{2+}	1.43	1.57	1.09	1.27	**1.34**	1.70	5.00
Mg^{2+}	1.30	1.24	1.21	1.61	**1.34**	1.40	2.70
Na^{+}	10.10	8.53	9.07	11.30	**9.75**	12.50	14.30
K^{+}	0.48	0.36	0.68	0.53	**0.51**	0.30	0.10
Cl^{-}	19.60	15.30	20.20	23.20	**19.58**	11.30	32.06
$SO4^{2-}$	<10	2.34	3.61	3.72	**<4.92**	4.50	7.67

Figure 19 Dissolved oxygen and temperature profile for Lough A Waddy (26/08/2014)

Dissolved Oxygen Profile

GPS Location	H0414464951
Maximum Depth (m)	2.6 m
Secchi Depth (cm)	0.38 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	10	14.2
0.5	9.93	14.2
1	9.88	14.1
1.5	9.89	14.1
2	9.55	14



Hydrology

Lough A Waddy has no apparent inflow stream. The lough drains to both the northwest and southwest. The hydrological regime at the site appears natural.

Lake substrate

Although the lough's catchment is dominated by peat, the lake shores have a mix of characteristics, ranging from a sandy beach to the east, coarse mineral to the north and peat hags to the west. The shallow water areas have similarly mixed substrates, ranging from coarse to fine mineral. Sandy substrates predominate in the deeper water areas of S1, whereas silts predominate in the open water of S2.

Sediment load

No grazing or poaching was observed at the time of survey, but the lough is surrounded by pasture. Evidence for poaching was noted in the 2006 survey, alongside an abundance of *J. bulbosus* growth, which could have indicated an increase in sediment loading to the lake. In this recent survey, *J. bulbosus* was recorded in low frequency which could suggest that any sediment loading which did occur in 2006 has since reduced.

Indicators of local distinctiveness

Elatine hexandra was recorded in survey section 3 and was previously recorded as a common species in 2006, for the first time at Lough A Waddy. This is a rare species in Northern Ireland and although it is widespread in Europe, is apparently under recorded (Silverside, 2015). It has since been recorded in 2010 and in nearby Lough Vearty in 2011 (Northridge *et* al, 2014). It was not recorded at the site in 1988.

Summary

Lough A Waddy achieves the necessary floristic requirement as defined within the CSM guidance (JNCC 2015) for "oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*". Five characteristic species were present and the *Littorelletea* flora showed the typical zonation pattern. Comparison of the 1988, 2006 and 2014 macrophyte species lists and TRS/PLEX scores suggests that there has been little change in the lough's aquatic macrophyte flora and trophic status over the last 26 years. The 2014 survey recorded a low frequency of *E. hexandra*, a species absent from the 1988 survey, either through oversight or because it was genuinely absent from the lough at this time. The water is peaty brown and the surrounding catchment characteristics suggest that the lough receives a moderate input of organic sediments, which may be contributing to the mean annual TP concentration. This has however decreased significantly by 35.2% since 2006, suggesting that the input of organic sediments has also decreased over time. Significant evidence for poaching was observed in 2006, but in this recent survey little to no poaching was recorded. This could account for the notable decline in TP concentration.

This site is a good example of an oligotrophic lough dominated by an abundant *Littorelletea* flora and showing the appropriate zonation pattern. The current survey therefore places the lough in **favourable, at risk** condition.

Table 79 Lough A Waddy: Overview

Water Body	Status	Reason(s) for Failure / concern	Comments
Lough A Waddy NI Lake 657	**Favourable, (at risk)**	Slightly elevated TP and higher than expected filamentous algae.	Good example of an oligotrophic lough dominated by abundant *Littorelletea* flora, which shows typical zonation. TP is slightly above target levels for an oligotrophic lough, although this may be influenced by the site's organic input and may not be of concern.

Species list

Table 80 Lough List of all plant species recorded at Lough A Waddy: 2015

Marginal & Emergent species	Abundance (DAFOR)
Blechnum spicant	R
Calluna vulgaris	R
Caltha palustris	R
Carex demissa	R
Carex elongata	R
Carex nigra	O
Carex rostrata	R
Drosera rotundifolia	R
Eleocharis palustris	O
Equisetum fluviatile	R
Erica tetralix	R
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	F
Juncus articulatus	O
Juncus bulbosus	R
Juncus effusus	R
Molinia caerulea	O
Mosses unid	O
Myrica gale	R
Narthecium ossifragum	R
Phalaris arundinacea	R
Polygala serpyllifolia	R
Potentilla erecta	R
Ranunculus flammula	O
Sparganium angustifolium	R
Sphagnum sp.	F
Succisa pratensis	R
Vaccinium myrtillus	R
Viola palustris	R

Submerged & floating species	% Frequency (n = 83)
Elatine hexandra	6
Fontinalis antipyretica	15
Isoetes lacustris	60
Juncus bulbosus	10
Littorella uniflora	9
Lobelia dortmanna	44
Myriophyllum alterniflorum	17
Nitella flexilis agg.	5
Potamogeton natans	6
Potamogeton polygonifolius	2
Sparganium angustifolium	1
Sphagnum sp.	20

Survey data

Site Condition Assessment: A Waddy Lough (26/08/2014)

Lake Details		**Survey Details**		
Lake Name	A Waddy Lough	Survey Date	26/08/2014	
SSSI Name		Surveyors	SG, ST	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H041650	Wader Surveys	3	3
WBID / NI No.	50159 / 657	Boat Surveys	3	sections

Site
Conifers on N and S side, ~25%. Water slightly brown. Isoetes to ~ 1.4m, S. ang and P. nat ~1.3m. M. alt occ. - only small plants. Lobelia abundant to ~1m. M ust **** Litt less common.

Survey

Section Summaries

Section 1	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	24 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes:	
Section 2	Maximum depth of colonisation (cm)	130 cm
	Compass bearing of boat transect (°)	74 °
	Lateral distance from waters edge to 75cm depth (m)	3 m
	Notes:	
Section 3	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	-
	Notes: Freshwater sponge found in points 1-5 at 50 & 75cm	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end
Section 1	H0394764945	H0393665035	-	H0404064991
Section 2	H0427065028	H0428965124	H0426765079	H0423365075
Section 3	H 04072 65050	H 04180 65053	H 04116 65044	H 04122 65029

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	135-0430	135-0431	-
Section 2	135-0433	135-0434	135-0435
Section 3	2531	2532	2529

3.15. Parabaun Lough 664 (MA, Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*.

Survey Date	29 June 2014
NI Lake Number:	664
WBID:	50347
County:	Fermanagh
Grid reference:	H059572
OS Grid reference (X,Y):	205920,357152
Shoreline development index:	1.397
Surface area (ha.):	3.3
Maximum recorded depth (m):	6.4

Table 81 Condition Assessment Summary Table for Parabaun Lough.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed (≥ 2 if valid reasons suggest otherwise)	**X?**	2 present: *Isoetes lacustris* & *Littorella uniflora*
	Mesotrophic: ≥ 8 characteristic species	**X**	2 characteristic broadleaf *Potamogeton* spp. - *P. alpinus* & *P. praelongus*. 4 other characteristic spp.: *I. lacustris, L. uniflora, Nitella flexilis* & *Nitella confervacea* (a Near Threatened species)

Attribute	Target	Status	Comment
	No loss of characteristic species	✓	Gain of 3 characteristic spp. since 1989: *I. lacustris, P. alpinus* & *N. flexilis*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	58% of vegetated sample spots comply for mesotrophic species. (45% wader survey, 88% boat. Only one boat survey completed)
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	No filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	✓**?**	Rich marginal habitat of sedges, rushes and herbs. Few areas of fringing emergent vegetation (*S. lacustris, C. rostrata, E. fluviatile, T. latifolia*) giving way to moorland heath and coniferous plantation. *N. lutea* in localised patches in S1 (25-50 cm). *N. confervacea* frequent in S1 in slightly deeper water (75-95 cm), sporadic *Chara* sp. at 75 cm. *N. flexilis* in S2 (25 cm). *P. praelongus* at 75-95 cm in SW (S1) and *P. alpinus* to NE (S2) between 25-75 cm. *F. antipyretica* frequent in S1 between 25-95 cm. *Littorelletea* flora only in NE of lough (S2): *I. lacustris* & and *L. uniflora* at 25 cm. *M. alterniflorum* also at 25 cm. S3 on SE shore devoid of plants.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 6.4 m, Z_s = 0.55 m, Z_v = 0.95 m.
	At least the present structure should be maintained	**?**	Previous data insufficient for comparison.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1} Mesotrophic = 15 µgl^{-1}	**X**	TP = 24 µgl^{-1} (range 16 - 33) & TN = 0.64 mgl^{-1} (April '14 – Feb. '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.2 (range = 7.0 – 7.4).
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	**X**	Waters well oxygenated: DO >5 mgl^{-1} from 0 – 3 m. Mean DO below the thermocline (below 4m) is 2.7 mgl^{-1}

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	Predominantly peat catchment on limestone bedrock. Silty in S1 and silts in open water. Mixed substrates in S2 & S3.
Sediment load	Natural sediment load maintained	✓	Lough surrounded by coniferous plantation. No grazing or poaching observed.
Indicators of local distinctiveness	Distinctive elements maintained	✓	The Near Threatened *Nitella confervacea* was recorded in 1989 and has also been recorded in 2014.
	Minimal negative impacts and no fish farming	**X?**	Coniferous plantation surrounds lough. No other pressures observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 3.3 ha with no loss of extent to the open water.

Macrophyte community composition

Parabaun Lough lies within a catchment of shallow peats and small areas of exposed limestone bedrock. Two characteristic oligotrophic species were recorded in 2014: *Isoetes lacustris* and *Littorella uniflora.* Six characteristic mesotrophic species were recorded, including two broadleaf *Potamogeton* species: *P. alpinus* and *P. praelongus.* Other characteristic species were *I. lacustris, L. uniflora, Nitella flexilis* and *Nitella confervacea.* Although three species were gained since the 1989 NILS survey (*I. lacustris, P. alpinus* and *N. flexilis),* Parabaun Lough fails to achieve the favourable condition target for characteristic species, particularly as only 58% of vegetated sample plots contained mesotrophic characteristic species and so therefore fails to reach the abundance target. Other submerged and floating-leaved aquatic macrophyte taxa growing in the lough were *Chara* sp., *Fontinalis antipyretica, Myriophyllum alterniflorum* and *Nuphar lutea.* A full species list can be found in Table 85 below.

Only two species that were recorded in 1989 were not recorded in 2014: *Lemna minor* and *Nymphaea alba*, neither of which are characteristic species for oligotrophic to mesotrophic standing water. Given the differing the survey methods employed between 1989 and 2014, it is perhaps not surprising that there are slight variations between the survey species lists.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 6.4 and 5.42 respectively (Table 82). The scores are lower than

those calculated from the 1989 survey data, suggesting that the trophic status of the lough has improved over the past 24 years.

Table 82 Aquatic macrophyte community composition for Parabaun Lough, including trophic scores.

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=33)***
Chara sp.	8.5	7.69	1	8.5	7.69	3
Fontinalis antipyretica	6.3	5.38	2	6.3	5.38	54.5
Isoetes lacustris	**-**	**-**	**-**	**5.0**	**4.23**	**3**
Lemna minor	**9.0**	**8.85**	**2**	**-**	**-**	**-**
Littorella uniflora	**6.7**	**4.23**	**3**	**6.7**	**4.23**	**6.1**
Myriophyllum alterniflorum	5.5	4.23	2	5.5	4.23	3
Nitella confervacea	**5.5**	**5.38**	**+**	**5.5**	**5.38**	**39.4**
Nitella flexilis	**-**	**-**	**-**	**5.5**	**5.38**	**3**
Nuphar lutea	8.5	6.92	2	8.5	6.92	9.1
Nymphaea alba	6.7	3.08	2	-	-	-
Potamogeton alpinus	**-**	**-**	**-**	**5.5**	**5.38**	**9.1**
Potamogeton praelongus	**7.3**	**5.38**	**2**	**7.3**	**5.38**	**24.2**
Average score	**7.1**	**5.68**		**6.4**	**5.42**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

No alien or nuisance species were recorded from the site.

Macrophyte community structure

Parabaun Lough is surrounded by moorland/ heath, which merges into the coniferous woodland of Lough Navar Forest. The marginal habitat consists of a diverse range of sedges, rushes and low growing herbs, including *Carex curta, C. limosa, C. rostrata, C. nigra, Juncus acutiflorus, J. effusus, Cardemine pratensis, Lychnis flos-cuculi, Myrica gale* and a range of liverworts. There are few areas of fringing vegetation; the majority is confined to the southwest shore of the lake and consists of *Schoenoplectus lacustris, Carex rostrata Equisetum fluviatile* and *Typha latifolia. Nuphar lutea* was found to be growing in localised, small patches in the southwest corner of the lough, at depths of between 25 – 50 cm. *Nitella confervacea* was frequent in this section, growing further out at slightly greater depths of 75 – 95 cm. *Chara* spp. was less common, recorded only once at 75 cm. *Nitella flexilis* was found in the shallows of the northeastern shore of section 2, at 25 cm only. *Potamogeton praelongus* was occasionally recorded between 75 – 95 cm in section 1 (southwest), while *Potamogeton alpinus* was found only in section 2 (northeast) between 25 – 75 cm. *Fontinalis antipyretica* was frequent in section 1 between 25 – 95 cm. *Littorelletea* flora was only recorded in the northeast quadrant of the lough

(section 2), with *Isoetes lacustris* and *Littorella uniflora* both sporadically growing only at a depth of 25 cm. *Myriophyllum alterniflorum* was also growing at this depth in section 2, recorded only once. Section 3, located along the southeastern shore, was devoid of plants both on the wader transect and boat transect.

Overall, the distribution of aquatic macrophytes in Parabaun Lough was rather patchy and could be attributed to the limited penetration of light through the water column (Z_s= 0.55 m). However, the presence of the Near Threatened *N. confervacea* at a frequent local abundance, and to a lesser extent the nationally scarce *N. flexilis*, suggests that the current structure is considered favourable.

Water quality

The water chemistry of Parabaun Lough is fairly typical for a low to moderate alkalinity mesotrophic lough, having a circumneutral pH and slightly elevated nutrient and ionic concentrations. The water colour was peaty brown throughout the lough, limiting light penetration to only 0.55 m. Total phosphorus is significantly higher than the target level set in the CSM guidelines for this lake type (15 μgl^{-1} JNCC 2015), rendering the trophic conditions unfavourable. However, total nitrogen was low and the lough shows limited direct evidence of the effects of nutrient enrichment: filamentous algae was not recorded and Chl *a* is low. Comparison of the 1989 and 2014 water chemistry data suggests that there has been a slight improvement in water quality over the last 24 years (although care should be taken in drawing conclusions from these two sets of independent water chemistry data). At the time of survey, the lough was well oxygenated between 0 – 3 m (DO= 5.95 – 9.16 mgl^{-1}), declining to 2.45 – 3.1 mgl^{-1} between 4 – 6 m. The mean DO below the thermocline was 2.7 mgl^{-1} which does not meet favourable status under CSM guidelines (JNCC 2015) However, the brown water is likely to be the factor limiting the DO levels at depth.

Table 83 Water chemistry data for Parabaun Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '14	Mean	1988
TP	19.5	32.5	30.1	15.6	**24.43**	49
SRP	3.7	7.5	7.7	3.3	**5.55**	6
TN	0.59	0.68	0.91	0.36	**0.64**	0.68
TON	<0.005	0.007	0.036	0.014	**<0.016**	-
Nitrite	0.003	0.001	0.001	0.001	**0.002**	-
Chl *a*	4.73	2.06	1.1	0.66	**2.14**	15.9
DOC	13.3	21.6	27.2	12.6	**18.68**	-
pH	7.25	7.4	6.99	7.04	**7.14**	7.94
Alk	27	37	34	17	**28.75**	18.2
Cond	107	103	103	125	**109.5**	150
Ca^{2+}	9.65	12.2	11.9	9.26	**10.75**	15
Mg^{2+}	1.67	1.82	1.73	2.06	**1.82**	2.32
Na^{+}	10.7	9.54	10.3	14.2	**11.19**	8
K^{+}	0.29	0.25	0.3	0.42	**0.31**	0
Cl^{-}	20.6	15.9	18.2	30	**21.18**	23

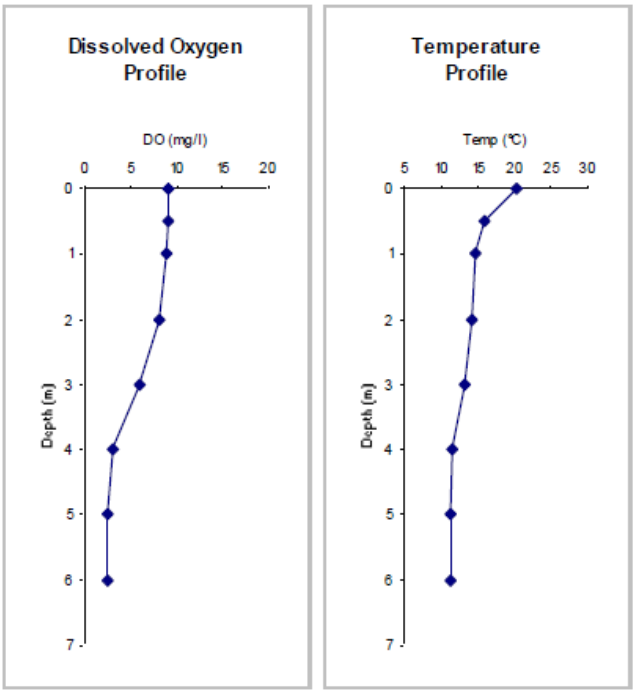
$SO4^{2-}$	<10	3.5	4.5	5.4	**5.85**	5.3

Figure 20 Dissolved oxygen and temperature profile for Parabaun Lough (29/06/2014)

Dissolved Oxygen Profile

GPS Location	H0594857125
Maximum Depth (m)	6.4 m
Secchi Depth (cm)	55 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	9.16	20.2
0.5	9.13	16
1	8.85	14.7
2	8.11	14.3
3	5.95	13.3
4	3.1	11.6
5	2.55	11.4
6	2.45	11.4



Hydrology

Parabaun Lough has no apparent inflow streams. The lough drains to the east, where a stream flows off the Cliffs of Magho as a waterfall. From there, it is possible that the water flows via streams and groundwater into Lower Lough Erne, which is located a little over a one kilometre to the north. The hydrological regime at the site appears natural.

Lake substrate

Parabaun Lough is situated in a catchment that is predominantly peat, underlain by limestone bedrock. Section 1 comprises mainly of root mass, which becomes silt with deeper water. Mixed substrates consisting of gravel, pebbles and boulders dominate the shallows of sections 2 and 3.

Sediment load

The lough is surrounded by coniferous plantation, where no grazing or poaching was observed. Therefore there was no direct evidence of increased sedimentation to the lough.

Indicators of local distinctiveness

According to IUCN (2001), the nationally rare stonewort *Nitella confervacea* holds a Near Threatened status (NBN Gateway, 2013). With few populations in Northern Ireland, it was recorded in Parabaun Lough during the NILS 1989 survey with an

unknown abundance. It has also been reported nearby in Lough Navar (NBN Gateway, 2013) and also in 2006 at Lough Nafeola at depths between 75 – 160 cm on peat substrate.

Summary

Parabaun Lough is classified as an "oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*" but does not achieve the necessary floristic requirement as defined with the CSM guidance (JNCC 2015) for either an oligotrophic or mesotrophic water body. Two oligotrophic characteristic species were present in 2014, and only six mesotrophic characteristic species were present, including two broadleaf *Potamogeton* species. Their coverage also did not meet the target for favourable condition, neither did the lough's water quality. Total phosphorus concentrations, on average, exceeded the upper limit as set by the CSM guidance (JNCC 2015). However, the nationally rare and Near Threatened stonewort species *Nitella confervacea* was recorded growing in Parabaun Lough with frequent abundance while the nationally scarce *Nitella flexilis* was also present. Comparison of the 1989 and 2014 data suggests that the aquatic macrophyte flora has remained relatively stable over the last 24 years, with three characteristic species gained. The differences in overall species composition most likely reflects the differing nature of the survey methods used in 1989 and 2014, along with interannual variation in aquatic macrophyte populations. The current survey places the lough in **unfavourable** condition.

Table 84 Parabaun Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Parabaun Lough NI Lake 664	**Unfavourable**	Did not meet the floristic composition targets or coverage. TP concentrations exceeded the upper limit for mesotrophic water bodies.	Diverse and rich marginal species. Notable species: *N. confervacea* and *N. flexilis* present in 2014. Trophic status appears to have improved since 1989, with three additional characteristic species.

Species list

Table 85 List of all plant species recorded at Parabaun Lough: 2014

Marginal & Emergent species	Abundance (DAFOR)
Salix sp.	F
Equisetum fluviatile	O
Caltha palustris	O
Carex nigra	O
Carex rostrata	O
Schoenoplectus lacustris	O
Typha latifolia	O
Juncus acutiflorus	R
Mentha aquatica	R
Liverworts unid	R
Galium palustre	R
Lychnis flos-cuculi	R
Juncus effusus	R
Myrica gale	R
Mosses unid	R
Cardamine pratensis	R
Senecio aquaticus	R
Potentilla palustris	R
Sphagnum sp.	R
Carex curta	R
Carex limosa	R
Phragmites australis	R
Menyanthes trifoliata	R
Myosotis laxa	R
Veronica scutellata	R
Ranunculus flammula	R
Angelica sylvestris	R
Rhinanthus minor	R
Succisa pratensis	R
Eriophorum vaginatum	R
Submerged & floating species	**% Frequency (n = 74)**
Chara sp.	3
Fontinalis antipyretica	55
Isoetes lacustris	3
Littorella uniflora	6
Myriophyllum alterniflorum	3
Nitella confervacea	39
Nitella flexilis	3
Nuphar lutea	9
Potamogeton alpinus	9
Potamogeton praelongus	24

Survey data

Site Condition Assessment: Parabaun or Finnauan Lough (29/06/2014)

Lake Details		**Survey Details**		
Lake Name	Parabaun or Finnauan Lough	Survey Date	29/06/2014	
SSSI Name		Surveyors	SG, BG	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H059572	Wader Surveys	3	3
WBID / NI No.	50347 / 664	Boat Surveys	1	sections

Site

Survey
S1: Transects located around a curve and on a bed of deep silt at 50cm and above.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	95 cm
		Compass bearing of boat transect (°)	230 °
		Lateral distance from waters edge to 75cm depth (m)	35 m
		Notes: BG Camera.	
Section	**2**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	12 m
		Notes: No boat transect - zero vegetation	
Section	**3**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	6 m
		Notes: No boat or wader survey due to no vegetation	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H0586557083	H0577357123	H0582157107	H0588257156
Section	**2**	H0608057186	H05598257212	-	-
Section	**3**	H0608957154	H0599257116	-	-

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	2451	2452	2455
Section	**2**	2456	2457	2458
Section	**3**	2463	2465	2464

3.16. Bunnahone Lough 666 (LA, VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* – assessed as mesotrophic

Survey Date	09 July 2014
NI Lake Number:	666
WBID:	50041
County:	Fermanagh
Grid reference:	H100551
OS Grid reference (X,Y):	209960,355103
Shoreline development index:	1.467
Surface area (ha.):	28.1
Maximum recorded depth (m):	7

Table 86 Condition Assessment Summary Table for Bunnahone Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	**X**	2 characteristic broadleaf *Potamogeton* spp. (*P. alpinus & P. perfoliatus*). 2 other characteristic species: *Littorella uniflora & Nitella flexillis agg.*
	No loss of characteristic species	✓	No loss of characteristic species since the 1988 survey.
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	**X**	14% of vegetated sample spots comply for mesotrophic species.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present but a low frequency.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Very little filamentous algae recorded (mostly 1s)
Macrophyte community structure	Characteristic vegetation zones should be present	✓**?**	A thin fringe of emergent vegetation (*S. lacustris*, *P. australis, E. fluviatile* and *E. palustris*.), occasionally denser patches of *S. lacustris* giving way to deciduous woodland and rough pasture. Occasional patches of *L. uniflora, Juncus bulbosus* and *Nitella flexilis agg.* in the shallows. *N. lutea* & *N. alba* fringe some areas up to 0.80m. Few submerged plants beyond the lily fringe. Broad leaved *Potamogeton* spp. occur occasionally in the shallows 0.40 – 0.75mm.
	Maximum depth distribution should be maintained	✓	Z_{max} = 7 m, Z_s = 0.51 m, Z_v = 1.1 m.
	At least the present structure should be maintained	✓	No evidence of change
Water quality	Stable nutrients levels: TP target / limit: Mesotrophic = 20 μgl^{-1}	**X**	TP = 69 μgl^{-1} (range 21-145) & TN = 0.90 mgl^{-1} (April '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.38 (range = 7.19 – 7.55).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	**X**	Surface water well oxygenated to 4 m, below which levels rapidly dropped off to a mean of 0.36 mgl^{-1}.below the thermocline.
	No excessive growth of cyanobacteria or green algae	✓	None recorded
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of sand and silt substrates at the margins and predominantly silt in deeper water (>0.75m).
Sediment load	Natural sediment load maintained	✓**?**	Cattle grazing and poaching in parts may lead to increased sediment load. Forest operations within the catchment.
	Distinctive elements maintained	✓	None specified.

Attribute	Target	Status	Comment
Indicators of local distinctiveness	Minimal negative impacts and no fish farming	✓?	Extent of grazing unknown.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 28 ha with no loss of extent to the open water.

Macrophyte community composition

Table 87 Aquatic macrophyte community composition for Bunnahone Lough, 2014 including trophic scores

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=74)***
Callitriche hamulata	5.0	6.15	3	-	-	-
Chara globularis	8.5	7.69	3	-	-	-
Eleogiton fluitans	4.0	3.08	3	-	-	-
Elodea canadensis	8.5	7.95	3	8.5	7.95	1.2
Fontinalis antipyretica	6.3	5.38	3	6.3	5.38	4.7
Juncus bulbosus	-	-	-	3.7	3.08	3.5
Littorella uniflora	**6.7**	**4.23**	**3**	**6.7**	**4.23**	**2.4**
Nitella flexilis agg.	**-**	**-**	**-**	**5.5**	**5.38**	**1.2**
Nuphar lutea	8.5	6.92	3	8.5	6.92	55.3
Nymphaea alba	6.7	3.08	3	6.7	3.08	3.5
Potamogeton alpinus	**5.5**	**5.38**	**3**	**5.5**	**5.38**	**10.6**
Potamogeton obtusifolius	7.3	6.54	3	7.3	6.54	12.9
Potamogeton perfoliatus	**7.3**	**7.69**	**1**	**7.3**	**7.69**	**1.2**
Potamogeton pectinatus	-	-	-	10.0	8.85	1.2
Potamogeton natans	-	-	-	6.7	4.23	+
Sparganium emersum	10.0	7.5	4	10.0	7.5	18.8
Average score	**7.7**	**6.88**		**7.9**	**6.88**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. – a "+" denotes species recorded outside the survey sections.

Bunnahone Lough is part of the Silees River catchment. The rivers source is in the Lough Navar forest to the west of the Lough. The river flows through blanket bog, conifer plantations and rough pasture before entering Bunnahone Lough on its western shore. As a result of the predominantly peat catchment the water of the lough is very brown, a factor which limits plant growth at depth. In terms of mesotrophic species, two characteristic *Potamogeton* spp. were recorded (*P.*

perfoliatus and *P. alpinus*). Two other characteristic species were present (*Nitella flexilis agg*. & *Littorella uniflora*). At least 1 of the characteristic species were present in 14% of the submerged survey plots. Other submerged and floating-leaved aquatic macrophyte taxa growing in the lough included: *Elodea canadensis, Juncus bulbosus, Nuphar lutea, Nymphaea alba, Potamogeton pectinatus, Potamogeton obtustifolius and Potamogeton natans.* Marginal emergent vegetation included *Phragmites australis*, *Schoenoplectus lacustris, Typha latifolia, Carex rostrata, Equisteum fluviatile, Eleocharis palustris, Juncus effusus* and *Ranunculus flammula*.

Species recorded in the 1988 NILS survey but absent from the 2014 survey were *Eleogiton fluitans and Chara globularis.* Species recorded in 2014 but not in 1988 were *P. pectinatus, Juncus bulbosus* and *Nitella flexilis agg.* The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site (Table 3) are highly comparable to those calculated from the 1988 suggesting minimal change in trophic status in that time.

Negative indicator species

Elodea canadensis was recorded at a low frequency (1.2%), so within limits deemed acceptable for this lake type (JNCC 2015).

Macrophyte community structure

The majority of Bunnahone Lough is fringed with a marginal zone of *P. australis*, *S. lacustris* and *E. fluviatile*, in some areas this marginal fringe of reeds was dense forming almost fen like habitat. In other areas the reeds were very sparse (S2) where occasional patches of *S. lacustris* grew alongside *E. fluviatile* and *E. palustris*. Patches of *Nuphar lutea* and *Nymphaea alba* occur around the lough up to the >75cm submerged sample plot. The broadleaved *Potamogeton* species (*P. alpinus* & *P. perfoliatus*) grew in the shallows (0.40 -0.70m depth). Few submerged plants grow beyond the water lily fringe and the boat transects only recorded floating leaved and emergent taxa >0.75m. Little in the way of zonation was recorded, probably due to the brown water (Z_s = 0.51 m) which limits plant growth at depth. The marginal vegetation is diverse with a total of 44 species of aquatic plants recorded in the 2014 survey.

Water Chemistry

Total phosphorus is higher than the target level set in the CSM guidelines for this lake type (20 μgl^{-1} JNCC 2015) (see Table 88) with an extremely high spring value which is of concern. Nitrogen was possibly limiting in spring, which may account for low algal productivity in the lough during the peak growing season; something more commonly seen in dystrophic lakes (Pålsson & Granéli 2004). While Bunnahone is not a typical dystrophic lake, it does have brown water, which is consistent with higher levels of humic compounds.

The lough, however, shows limited direct evidence of the effects of nutrient enrichment: i.e. filamentous algae cover and Chl *a* are low. Trophic conditions are therefore considered as atypical and the response to enrichment most likely influenced by the high humic content (and water colour), which can limit plant growth. Other water quality parameters are consistent with the lake type (i.e. mesotrophic, LA Sh). At the time of survey, the lake was stratified and had very low oxygen concentrations below the thermocline at approximately 4.5 m (Figure 21).

Hydrology

The Sillees River flows into Bunnahone Lough on its western shore and exits again on its eastern shore. Within the catchment of Bunnahone Lough includes blanket bog, conifer plantation and rough pasture. The hydrological regime appears natural.

Table 88 Water chemistry data for Bunnahone Lough, 2014/15

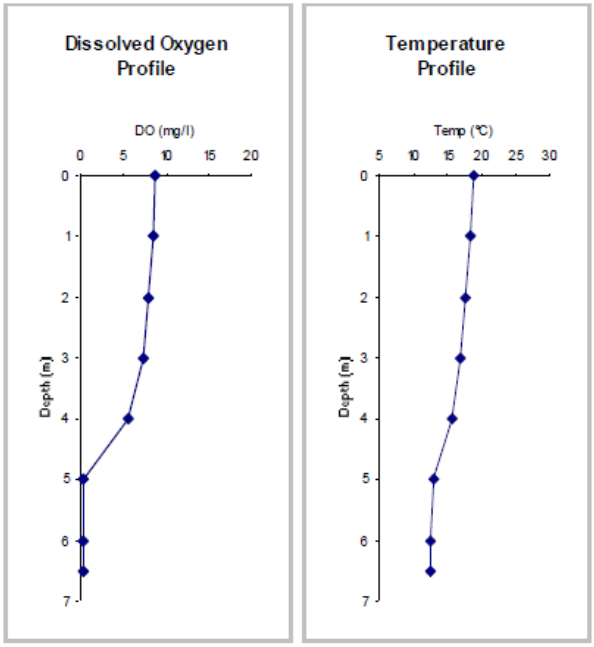
	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	145	61.5	50.8	21.1	**69.6**	36
SRP	8.5	20.4	11.9	7.7	**8.5**	9
TN	1.03	1.08	1.02	0.47	**0.9**	0.72
TON	0.041	0.128	0.108	0.116	**0.098**	-
Nitrite	0.003	0.009	0.002	<0.0010	**<0.004**	-
Chl *a*	8.36	3.52	2.42	0.77	**3.8**	10.08
DOC	10.9	23.2	21.6	8.01	**15.93**	-
pH	7.55	7.37	7.19	7.52	**7.38**	7.46
Alk	50	54	39	33	**44**	29
Cond	136	133	117	151	**134**	190
Ca^{2+}	19.2	17.9	14.6	14.3	**16.5**	20.2
Mg^{2+}	3.06	2.86	2.34	2.58	**2.71**	3.2
Na^{+}	8.06	7.62	7.43	8.39	**7.88**	11.5
K^{+}	1.03	1.05	1.16	0.842	**1.021**	0.7
Cl^{-}	14.6	13.1	16.2	26.1	**17.5**	21.47
SO_4^{2-}	<10	5.48	6.3	5.51	**<6.82**	7.06

Figure 21 Dissolved oxygen and temperature profile for Bunnahone Lough (09/07/2014)

GPS Location	H0988555006
Maximum Depth (m)	7 m
Secchi Depth (cm)	51 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	8.77	18.8
1	8.56	18.4
2	7.99	17.5
3	7.34	16.8
4	5.55	15.7
5	0.33	13
6	0.36	12.5
6.5	0.4	12.6



Lake substrate

At the margins the lake substrates are predominantly a mixture of sand and silt. The open waters are predominantly silt substrates.

Sediment load

As large tracts of forestry plantation occur in the upper reaches of the Sillee river it is likely that any forestry operation could impact on the sediment load of Lough Bunnahone. Also cattle grazing was observed at the time of the survey and heavy poaching was noted around section 2. This would be expected to increase the sediment load, but there was no evidence of any direct impact at time of survey.

Indicators of local distinctiveness

None noted.

Summary

Bunnahone Lough is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*” but clearly lies towards the mesotrophic end of this classification. The lake has a neutral pH, moderate levels of nutrients and floral characteristic of a mesotrophic lake, although not the required number of species to meet favourable status under CSM guidelines (JNCC 2015).

The annual mean TP levels are over three times the guidelines for shallow mesotrophic lakes (20 $\mu g l^{-1}$). The reasons for the high nutrient concentrations are unclear, but are likely to be due to a combination of factors. There is some agricultural improvement within the immediate catchment area which will inevitably contribute to nutrient enrichment. There are also extensive forestry operations higher in Lough Navar forest, which has also been reported as a likely sources of phosphorus in Northern Ireland (Gibson *et al.* 1995). Elevated P may be further compounded by nitrogen availability. It is possible that the site was N limited during spring, a phenomenon more often associated with dystrophic lakes, which can result

in elevated phosphorous concentrations without promoting primary production (Pålsson & Granéli 2004). While Bunnahone is not a typical dystrophic lake, it does have brown water which will inevitably impact on the ecology of the site. Despite high TP, there is no biological evidence of nutrient enrichment; planktonic and filamentous algal biomass was low, and there was no dominance of macrophyte taxa that often favoured by enrichment (e.g. *J. bulbosus*). Nonetheless, under the guidelines set out in the favourable condition tables Bunnahone is in **unfavourable condition** with respect to water quality.

The flora of the site contains 4 characteristic species including 2 broadleaved *Potamogeton* species (*P. alpinus* & *P. perfoliatus*) as well as *Littorella uniflora* and *Nitella flexilis agg. Elodea canadensis* has been present in the lough at least since the survey in the 1980's but it doesn't appear to be a problem in the lough only occurring at 1 sample plot. It is likely the growth of *Elodea canadensis* (and other submerged plants) is limited by the very brown waters. Despite the floristic not meeting the CSM guidance (JNCC 2015) the lough is still a reasonable example of a mesotrophic system and one which appears to be stable when compared to past records. The very brown water and high DOC makes this site atypical for mesotrophic waters and therefore it is recommended that site specific targets be set in order to better assess the site condition. Paleaoecological evidence would be beneficial in determining what changes (floristically and in water quality) have occurred as a result of forestry and changes in land use.

Within the CSM guidance however, Bunnahone Lough is classed as **unfavourable** due to it failing to meet a number of key targets (JNCC 2015).

Table 89 Bunnahone Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Bunnahoneh Lough NI Lake 666	**Unfavourable**	Above target TP and insufficient number of characteristic species.	Despite failure, a reasonably good example of a mesotrophic lake. Complex interactions of the brown water and high DOC are thought likely to make this lough atypical for its type and hence site specific targets should be sought to better determine overall condition. The lough appears stable and the flora is similar to that recorded in the 1980's (NILS).

Species list

Table 90 List of all plant species recorded at Bunnahone Lough in 2014

Marginal & Emergent species	Abundance (DAFOR)
Schoenoplectus lacustris	A
Nuphar lutea	F
Phragmites australis	O
Sparganium emersum	O
Salix sp.	R
Carex rostrata	R
Equisetum fluviatile	R
Alnus glutinosa	R
Juncus effusus	R
Galium palustre	R
Filipendula ulmaria	R
Lythrum salicaria	R
Myosotis scorpioides	R
Eleocharis palustris	R
Valeriana officinalis	R
Phalaris arundinacea	R
Mentha aquatica	R
Senecio aquaticus	R
Caltha palustris	R
Carex paniculata	R
Hydrocotyle vulgaris	R
Typha latifolia	R
Alisma plantago-aquatica	R
Juncus articulatus	R
Lysimachia nummularia	R
Ranunculus flammula	R
Callitriche sp.	R
Equisetum arvense	R
Lychnis flos-cuculi	R
Epilobium hirsutum	R
Carex nigra	R
Veronica catenata	R
Menyanthes trifoliata	R

Submerged & floating species	% Frequency (n = 85)
Elodea canadensis	1.2
Fontinalis antipyretica	4.7
Juncus bulbosus	3.5
Littorella uniflora	2.4
Nitella flexilis agg.	1.2
Nuphar lutea	55.3
Nymphaea alba	3.5
Potamogeton alpinus	10.6
Potamogeton obtusifolius	12.9
Potamogeton perfoliatus	1.2
Potamogeton pectinatus	1.2
Potamogeton natans	+
Sparganium emersum	18.8

Survey data

Site Condition Assessment: Bunnahone Lough (09/07/2014)

Lake Details		**Survey Details**		
Lake Name	Bunnahone Lough	Survey Date	09/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	H100551	Wader Surveys	4	4
WBID / NI No.	50041 / 666	Boat Surveys	4	sections

Site Notes:

Survey Notes:
Compass Broken, Dead pike seen.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	80 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	40 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	110 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	25 m
		Notes: Rocky shore	
Section	**3**	Maximum depth of colonisation (cm)	80 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	25 m
		Notes:	
Section	**4**	Maximum depth of colonisation (cm)	80 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	15 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0984455371	H0993755371	H0990255355	H0991355326
Section	**2**	H1029655004	H1019554994	H1024655002	H1025055043
Section	**3**	H0970555094	H0962755040	H0968855065	H0970055039
Section	**4**	H0989254850	H0994054855	H0999154864	H0995354886

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0254	0259	0258
Section	**2**	0260	0261	0262
Section	**3**	0263	0264	0265
Section	**4**	0267	0269	0268

3.17. Lough Aleater (MA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	5 August 2014
NI Lake Number:	682
WBID:	50228
County:	Fermanagh
Grid reference:	G975495
OS Grid reference (X,Y):	197471, 349542
Shoreline development index:	1.155
Surface area (ha.):	5.25
Maximum recorded depth (m):	8.6

Table 91: Condition Assessment Summary Table for Lough Aleater.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓	5 present: *Apium inundatum, Baldellia ranunculoides, Littorella uniflora, Lobelia dortmanna* & *Sparganium angustifolium.*
	Mesotrophic: ≥ 8 characteristic species	**X**	1 broadleaf *Potamogeton* spp. (*P. alpinus*) and 6 other spp.: *A. inundatum, B. ranuculoides, L. dortmanna, L. uniflora, Sparganium angustifolium* and *Nitella flexilis.*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	*Potamogeton perfoliatus* recorded in July 1988, but not seen in 2006 or 2014. *Isoetes lacustris* recorded in 2006 but not in 2014. All non-characteristics recorded in 1988 and 2006 also recorded in 2014, except for *Eleogiton fluitans* and *Sparganium emersum.*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	55% of vegetated sample spots comply for oligotrophic species. (57% wader survey & 52% boat survey)
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	0% of sampling points scored a cover value of '3'.
Macrophyte community structure	Characteristic vegetation zones should be present	**X?**	Zones poorly defined. Fringing emergent vegetation patchy; E shore (S2) devoid of marginal vegetation for the first 40 metres; Along S, W & N margins, *P. australis, A. inundatum* & *C. rostrata* grow from 0 – 0.75 m, with *S. lacustris* from 0.5 – 0.75 m. *L. dortmanna* and *Chara virgata* fairly common in shallow water ≤ 0.75 m. *P. alpinus (S1 only)*, *L. uniflora, I J. bulbosus* very occasional ≤ 0.75 m. *N. alba* along W & N margins ≥ 0.5 m. *S. angustifolium* & *N. lutea* ≥ 0.35 – 2.2 m in both sections. *P. natans* & *F. antipyretica* frequent throughout at 0.45 - 1.6 m.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 8.6 m, Z_s = 0.85 cm, Z_v = 2.2 m.
	At least the present structure should be maintained	**X**	Poorly defined structure has not changed since 2006 – patchy and sparse coverage from expected species in each hydrosere.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	**X**	TP = 25.1 μgl^{-1} (range 15-44) & TN = 0.76 mgl^{-1} (April '14 – Feb. '15). Unfavourable for oligotrophic and mesotrophic.
	Stable pH values: Mesotrophic: pH 7.00-<8.00	✓	pH = 7.0 (range = 7.0 – 7.4).

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X?**	Waters were well oxygenated (DO = 7.9 mgl^{-1} at 2.0m, dropping to 0.15 mgl^{-1} at 5.0m). Mean DO = 5.7 mgl^{-1}. Mean DO below thermocline is 0.17 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Appears natural
	Natural and characteristic substrate maintained	✓	Patches of cobbles in shallow water. Mainly sandy substrate to E (S2). Silts to N (S1) and in deeper waters.
Sediment load	Natural sediment load maintained	✓	Grazing on rough pasture in catchment - impact minimal but poaching evident.
Indicators of local distinctiveness	Distinctive elements maintained	✓**?**	None specified
	Minimal negative impacts and no fish farming	✓	Some soft shore modifications – fence. Minimal grazing pressure.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 5.25 ha with no loss of extent to the open water.

Macrophyte community composition

The submerged aquatic flora, although relatively species rich and to some extent consistent with that expected for an Annex I type oligotrophic to mesotrophic standing water, is somewhat sparse and restricted to the margins due to poor light penetration through the water column. Five characteristic oligotrophic species were recorded: *Apium inundatum, Baldellia ranunculoides*, *Littorella uniflora, Lobelia dortmanna* and *Sparganium angustifolium*. In terms of characteristic mesotrophic species, only those species listed above, plus one broad-leaved *Potamogeton* spp (*Potamogeton alpinus*) and *Nitella flexilis* were recorded. Only one species was recorded in water depths >1m (*Potamogeton natans*).

Two species were notably absent from the 2014 survey, which were recorded in 2006: *Isoetes lacustris* and *Chara virgata* var. *annulata. Isoetes lacustris* only had a frequency of 1% in the 2006 survey, which suggests it could either have easily been missed in the recent survey, or it has further declined over the past eight years. The latter species is one which is indicative of stony sand and clay at lake margins (Moore, 1986) but again may have been missed in the recent survey. *S. angustifolium* was not recorded in 2006, but was originally observed in 1988, so the recent survey confirms its continuing presence. *Potamogeton perfoliatus* was recorded in 1988, whereas *P. alpinus* was recorded in 2006 and 2014. There is a possibility that *P. perfoliatus* was misidentified in 1988– voucher specimens from 1988 would need to be examined for confirmation.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 5.9 and 4.95 respectively (Table 92), so have decreased slightly from the values calculated for the 2006 species assemblage. The flora of Lough Aleater is most closely associated to lake type C2, as defined by Duigan *et al.* (2006), although the PLEX score and to some extent, the water chemistry is higher than the mean for this type, perhaps suggesting nutrient enrichment.

Table 92: Aquatic macrophyte community composition for Lough Aleater, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=48)***	**TRS**	**PLEX**	**% occurrence (n=60)***
Apium inundatum	**7.0**	**7.5**	**9**	**7.0**	**7.5**	**22**
Baldellia ranunculoides	**-**	**-**	**-**	**4.0**	**-**	**+**
Chara virgata	8.5	7.69	11	8.5	7.69	43
Chara virgata var. annulata	8.5	7.69	7	-	-	-
Eleocharis acicularis	8.5	7.95	2	-	-	-
Eleogiton fluitans	4.0	3.08	+	-	-	-
Fontinalis antipyretica	6.3	5.38	20	6.3	5.38	3
Isoetes lacustris	**5.0**	**4.23**	**1**	**-**	**-**	**-**
Juncus bulbosus	3.7	3.08	7	3.7	3.08	12
Littorella uniflora	**6.7**	**4.23**	**3**	**6.7**	**4.23**	**3**
Lobelia dortmanna	**5.0**	**3.08**	**20**	**5.0**	**3.08**	**43**
Myriophyllum alterniflorum			-	5.5	4.23	5
Nitella flexilis agg.	**5.5**	**5.38**	**5**	**5.5**	**5.38**	**15**
Nuphar lutea	8.5	6.92	10	8.5	6.92	27
Nymphaea alba	6.7	3.08	7	6.7	3.08	12
Potamogeton alpinus	**5.5**	**5.38**	**4**	**5.5**	**5.38**	**2**
Potamogeton natans	6.7	4.23	24	6.7	4.23	42
Sparganium emersum	10.0	7.5	18	-	-	-
Sparganium angustifolium			**-**	**3.0**	**4.23**	**5**
Average score	6.4	5.3		5.9	4.95	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

No alien or nuisance species were recorded from the site.

Macrophyte community structure

The zonation of aquatic macrophytes is poorly defined within Lough Aleater. In particular, the *Littorella uniflora* and *Lobelia dortmanna* flora which is often found in distinct zones in oligotrophic loughs was too sparse to show any characteristic zonation. *Isoetes lacustris* was absent from the survey. At the time of survey *L. uniflora* was recorded growing sparsely at water a depth of 0–25 cm only on the eastern side of the lough. *L. dortmanna* was recorded growing between 30 and 70 cm both on the eastern and northern sides of the lough. However the species' distribution was infrequent and occurring often with an abundance score of '1' out of '3'.

The margins are predominantly reed-fringed, but beyond this zone the marginal and emergent vegetation is limited. The eastern shore (S2) is very low on marginal vegetation, since the majority of the lake edge consists of low herbs bordering the pasture grassland (*Carex rostrata, Epilobium spp., Filipendula ulmaria, Juncus acutiflorus, J. effuses, Mentha sp.* and *Potentilla palustris*). Along the other shores, the fringing emergent vegetation grows in an almost continuous band, but is variable in terms of community composition: Along the southern, western and northern margins, varying abundances of *Phragmites australis, Apium inundatum* and*, Carex rostrata* grow in water depths of 0-50 cm, with *Schoenoplectus lacustris* growing at water depths of 50–75 cm. *L. dortmanna* is common in shallow water, growing at water depths of ≤ 75 cm. *J. bulbosus* was less common at similar depths, appearing sporadically along the northwestern shore. *C. virgata* grows at water depths of ≤ 75 cm, predominantly on the sandy substrate along the eastern side of the lough. *Juncus bulbosus* was also recorded in similar depths, but was far less abundant. *N. alba* grows in patches along the northern and western margins at water depths of ≥ 75 cm. *S. emersum* & *N. lutea* are typically found growing at water depths of ≥ 50-80 cm and *P. natans* frequent throughout at water depths of 45-160 cm. The water was peaty brown and was only clear enough during the survey to allow light penetration to 85 cm, with the vegetation limited to 220 cm depth. The current structure is considered to be unfavourable for a site of this type.

Water quality

The water chemistry of Lough Aleater is most typical of a mesotrophic lough, having approximately neutral pH and relatively low ionic concentration. According to the reporting typology for lakes in Great Britain (Phillips, 2003), Lough Aleater is considered to be a medium alkalinity lake, although its water colour suggests that catchment geology is in part organic. Unlike the dystrophic sites of the Garron Plateau the water colour in the lough is much lighter brown and consequently light penetration is higher, but less than might be expected in a clear-water lough. Total phosphorus is significantly higher than the target level set in the CSM guidelines for oligotrophic lakes (10 μgl^{-1}: JNCC 2015) and total nitrogen is also relatively high. However, the lough shows limited direct evidence of the effects of nutrient enrichment e.g. Chl *a* is low and there is no excessive growth of *Juncus bulbosus*. Filamentous algae was recorded at moderate levels however. Lough Aleater is considered to be in “unfavourable condition” with respect to trophic status. Other water quality parameters are consistent with the lake type (i.e. oligotrophic, MA Sh). The lake was well oxygenated throughout the photic zone (DO at 2 m was 7.9 mgl^{-1}) at the time of survey, although DO levels were below guideline levels below the thermocline.

Hydrology

Lough Aleater receives water from the east / southeast. Prior to entering Lough Aleater, the inflow stream passes through Round Lough. Lough Aleater drains to the southwest. The hydrology of the site appears natural.

Table 93: Water chemistry data for Lough Aleater

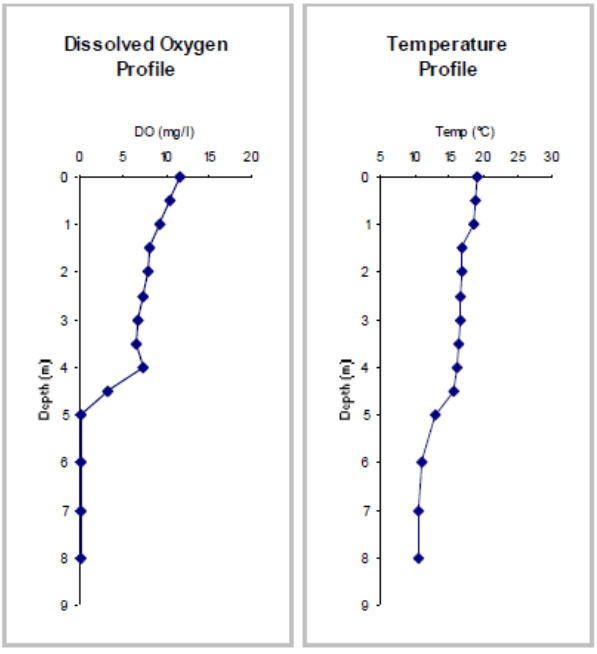
	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1988
TP	14.2	26.5	44.3	15.4	**25.1**	32	56
SRP	4.9	1.3	4.0	2.1	**33.1**	-	12
TN	0.6	0.77	1.11	0.56	**0.76**	0.85	0.78
TON	<0.005	<0.005	0.043	0.046	**<0.025**	-	-
Chl *a*	3.41	6.16	7.59	3.52	**5.17**	6.1	3.07
DOC	9.31	11.3	13.8	5.14	**9.89**	-	-
pH	7.43	7.35	7.13	6.96	**7.18**	7	6.49
Alk	28	35	40	16	**29.75**	39.2	45.5
Cond	97	98	108	139	**110.5**	100	114
Ca^{2+}	10.4	12	12.4	9.12	**10.98**	13.9	40.6
Mg^{2+}	1.33	1.45	1.57	2.28	**1.66**	7.3	1.8
Na^{+}	7.94	7.19	8.38	15.6	**9.78**	7.2	11.95
K^{+}	0.815	0.726	1.08	1.02	**0.91**	1	0.1
Cl^{-}	14.2	11.5	15.3	30.9	**17.98**	7.5	22.23
$SO4^{2-}$	<10	3.27	4.87	4.85	**5.75**	3.3	5.24

Figure 22: Dissolved oxygen and temperature profile for Lough Aleater (05/08/2014)

Dissolved Oxygen Profile

GPS Location	G9749549567
Maximum Depth (m)	8.6 m
Secchi Depth (cm)	0.85 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	11.65	19
0.5	10.5	18.9
1	9.4	18.7
1.5	8.2	17
2	7.9	16.8
2.5	7.29	16.7
3	6.85	16.6
3.5	6.65	16.4
4	7.4	16.2
4.5	3.3	15.6
5	0.15	12.9
6	0.16	11
7	0.17	10.6
8	0.2	10.6



Lake substrate

Silty substrates predominate in both the marginal and open water areas across much of Lough Aleater. However sands are dominant along the eastern lough margins.

Sediment load
There was no evidence of increased sediment load to the site.

Indicators of local distinctiveness
None specified.

Summary
Lough Aleater has a relatively rich submerged and floating-leaved aquatic macrophyte assemblage and in respect of this would be classed as favourable for oligotrophic type, but is insufficient to gain favourable status for the mesotrophic lough type. The aquatic vegetation was sparse in the deeper water areas and failed to achieve the target 60% of survey plots with at least one characteristic species for either lake type, although there has been an improvement since 2006, when only 44% of survey plots were recorded with as such. This lough was perhaps once oligotrophic and has become enriched with agricultural improvements in the catchment, possibly with an increase in species richness. The current chemistry is more akin to the mesotrophic lough type, with slightly elevated alkalinity and ionic concentration, but TP concentrations exceed the targets for both lough types and therefore the site is classified as being in **unfavourable** condition.

Despite the relatively rich aquatic flora, Lough Aleater does not meet the primary aquatic macrophyte and water quality targets and is therefore considered to be in **unfavourable condition** for both oligo- and mesotrophic lough types. It is recommended that further assessments are made of the aquatic vegetation to establish if the aquatic flora is stable and it is considered that palaeoecological investigation would be worthwhile in order to assess baseline targets for both nutrients and macrophytes. Low grazing intensity should be maintained and sources of enrichment should be identified and managed appropriately.

Table 94: Lough Aleater: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Aleater NI Lake 682	**Unfavourable**	Insufficient number (mesotrophic) and abundance (oligo- and mesotrophic) of characteristic species. Nutrient concentrations higher than target levels.	Relatively species rich site. Further monitoring and palaeoecological work recommended to set more precise targets for nutrients and species

Species list

Table 95: List of all plant species recorded at Lough Aleater

Marginal & Emergent species	**Abundance (DAFOR)**
Alisma plantago-aquatica	R
Alnus glutinosa	R
Angelica sylvestris	R
Apium inundatum	R
Calluna vulgaris	R
Caltha palustris	R
Carex rostrata	F
Eleogiton fluitans	R
Epilobium hirsutum	F
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum fluviatile	F
Filipendula ulmaria	R
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	F
Juncus bulbosus	R
Juncus effusus	O
Mentha sp.	O
Menyanthes trifoliata	R
Myosotis scorpioides	R
Phalaris arundinacea	R
Phragmites australis	A
Potentilla palustris	R
Ranunculus flammula	R
Schoenoplectus lacustris	F
Sparganium erectum	R
Succisa pratensis	R
Submerged & floating species	**% Frequency (n = 60)**
Apium inundatum	13
Baldellia ranunculoides	+
Chara virgata	26
Fontinalis antipyretica	2
Juncus bulbosus	7
Littorella uniflora	2
Lobelia dortmanna	26
Myriophyllum alterniflorum	3
Nitella flexilis agg.	9
Nuphar lutea	16
Nymphaea alba	7
Potamogeton alpinus	1
Potamogeton natans	25
Sparganium angustifolium	3

Survey data

Site Condition Assessment: Aleater Lough (05/08/2014)

Lake Details		Survey Details	
Lake Name	Aleater Lough	Survey Date	05/08/2014
SSSI Name		Surveyors	SG, EF
SAC Name		Shore Surveys	2 out of
Grid Ref (centre)	G975495	Wader Surveys	2 2
WBID / NI No.	50228 / 682	Boat Surveys	2 sections

Site Notes:

Survey Notes:

Section Summaries

Section 1

Maximum depth of colonisation (cm)	160 cm
Compass bearing of boat transect (°)	315 °
Lateral distance from waters edge to 75cm depth (m)	15 m

Notes: >75 could not be done. Too shallow at P2 & 3

Section 2

Maximum depth of colonisation (cm)	220 cm
Compass bearing of boat transect (°)	45 °
Lateral distance from waters edge to 75cm depth (m)	8 m

Notes:

Section Locations

	Shore Survey GPS Co-ords start	Shore Survey GPS Co-ords end	Boat Survey GPS Co-ords start (shore)	Boat Survey GPS Co-ords end (lake)
Section 1	G9736049604	G9735049660	G9635049635	G9740449597
Section 2	G9755249561	G9763049510	G9758449533	G9758449522

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	132-0399	132-0401	132-0402
Section 2	132-0403	132-0404	132-0405

3.18. Lough Anierin ASSI (MA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	7 August 2014
NI Lake Number:	689
WBID:	50216
County:	Fermanagh
Grid reference:	G996472
OS Grid reference (X,Y):	199551,347196
Shoreline development index:	1.125
Surface area (ha.):	6.2
Maximum recorded depth (m):	9.5

Table 96 Condition Assessment Summary Table for Lough Anierin.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed	✓	4 present: *Isoetes lacustris, Littorella uniflora*, *Lobelia dortmanna* & *Sparganium angustifolium.*
	Mesotrophic: ≥ 8 characteristic species listed	X	Only 1 broadleaf *Potamogeton* spp. (*Potamogeton alpinus*) and 5 other spp.: *I. lacustris, L. uniflora, L. dortmanna, Nitella flexilis* agg. & *S. angustifolium.*

Attribute	Target	Status	Comment
	No loss of characteristic species	✓?	*Nitella translucens* recorded in 1990 but not 2014. *N. flexilis* agg. recorded in 2014 but not 1990.
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	X	38% of vegetated sample spots comply for oligotrophic species (44% wader; 26% boat). 47% of vegetated sample spots comply for mesotrophic species (49% wader survey & 42% boat survey).
Negative indicator species	Non-native species absent or present at low frequency	✓?	*Crocosmia x crocosmiiflora* observed growing in the marginal habitat at low frequency.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	9% of sampling points scored a cover of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Improved grazing pasture surrounds lough, with some coniferous plantation. Wet woodland vegetation in margins: *A. glutinosa, J. acutiflorus, J. effusus, M. caerulea* and *Salix spp.* Emergent vegetation almost non-existent (*E. fluviatile;* occasional *P. australis* S1 only) to >75 cm. Good *Littorelletea* flora zonation: *L. uniflora* abundant in S2 (25-75 cm); *L. dortmanna* 50-75 cm; *I. lacustris* 75-110 cm. *S. angustifolium* S2 only (110-140 cm). Floating leaved and submerged flora: dominated by *P. natans* in S1 & S2 (25-210 cm). *P. alpinus* only S2 at 100-110 cm. Local beds of *N. flexilis* agg. in open water of S2 (50-100 cm), while *C. virgata* in shallower waters, 75- >75 cm. *M. alterniflorum* occasional in S2 50-75 cm, intermingled by *F. antipyretica* S1 & S2 (25-75 cm).
	Maximum depth distribution should be maintained	X	Z_{max} = 9.5 m, Z_s = 0.85 m, Z_v = 2.1 m.
	At least the present structure should be maintained	-	Previous data insufficient for comparison.

Attribute	Target	Status	Comment
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	**X**	TP = 32.6 μgl^{-1} (range 16-44) & TN = 0.69 mgl^{-1} (April '14 – Feb. '15). Unfavourable for both oligotrophic and mesotrophic
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.1 (range = 7.0 – 7.2).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X**	Waters moderately oxygenated within the photic zone: DO = 6-11 mgl^{-1} from 0 – 3.5 m; Mean value of DO below thermocline = 0.05 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	**X**	Blue-green algal bloom noted for both survey sections.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Appears natural.
	Natural and characteristic substrate maintained	✓	Peat catchment with exposed bedrock on the eastern shore. Sands dominate substrate from the shallows to the open water on north shore. A mosaic of root mass and sands in shallows on south shore, with silty substrates in open water.
Sediment load	Natural sediment load maintained	**X**	Grazing and poaching observed – possible increase in sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified although otter spraints were observed.
	Minimal negative impacts and no fish farming	**X**	Grazing and poaching observed – very turbid water.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 6.2 ha with no loss of extent to the open water.

Macrophyte community composition

Lough Anierin lies within a catchment of improved grazing pasture, underlain by shallow peats and areas of exposed sand and bedrock. Characteristic *Littorelletea* species recorded from the lough were *Isoetes lacustris, Littorella uniflora, Lobelia dortmanna* and *Sparganium angustifolium.* Other mesotrophic characteristic species were *Nitella flexilis* agg. and *Potamogeton alpinus.* Lough Anierin passes the oligotrophic but not the mesotrophic species compositional target. The 1990 NILS survey recorded *Nitella translucens*, which was not detected in the 2014 survey. However, *Nitella flexilis* agg. is an additional species to 2014. Lough Anierin does not meet the oligotrophic or mesotrophic species frequency target of >60% of sample plots having one or more characteristic species. Non-characteristic submerged and floating-leaved species include: *Chara virgata, Fontinalis antipyretica, Myriophyllum*

alterniflorum, Potamogeton natans and *Nymphaea alba.* The emergent vegetation was sparse within the survey, consisting only of *Equisetum fluviatile* and *Phragmites australis.*

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 5.9 and 4.65 respectively (Table 97). The scores calculated from the 1990 survey data were higher than those from 2014. This could be attributed to the one additional species present on the 1990 records that is not present in 2014, *Potamogeton berchtoldii*, which has a relatively high TRS and PLEX score. Aside from this species, the plant lists are almost identical between the two surveys. Therefore the lower current scores are not representative of a slight improvement in trophic status. The frequency of *P. natans* appears to have increased significantly over the past 24 years, recorded as 'abundant' in 2014 ('4' on a 1-5 scale) and 'frequent' ('3' on a 1-5 scale) in 1990. The *Littorelletea* flora have all been recorded as 'rare' ('1') in the current survey, while they appear as '2' or '3' in 1990. However, very different survey methods were employed between the two surveys, with SCA guidelines not followed in 1990, so direct comparisons must be treated with caution.

Table 97 Aquatic macrophyte community composition for Lough Anierin, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=58)***
Chara spp.	8.5	7.69	3	-	-	-
Chara virgata	-	-	-	8.5	7.69	3.4
Fontinalis antipyretica	6.3	5.38	2	6.3	5.38	15.5
Isoetes lacustris	**5.0**	**4.23**	**2**	**5.0**	**4.23**	**10.3**
Littorella uniflora	**6.7**	**4.23**	**3**	**6.7**	**4.23**	**17.2**
Lobelia dortmanna	**5.0**	**3.08**	**3**	**5.0**	**3.08**	**8.6**
Mosses (aquatic)	-	-	1	-	-	-
Myriophyllum alterniflorum	5.5	4.23	2	5.5	4.23	6.9
Nitella flexilis agg.	-	-	-	**5.5**	**5.38**	**13.8**
Nitella translucens	**5.5**	**5.38**	**+**	**-**	**-**	**-**
Nymphaea alba	6.7	3.08	2	6.7	3.08	+
Potamogeton alpinus	**5.5**	**5.38**	**2**	**5.5**	**5.38**	**3.4**
Potamogeton berchtoldii	7.3	7.69	2	-	-	-
Potamogeton natans	6.7	4.23	3	6.7	4.23	50
Sparganium angustifolium	**3.0**	**4.23**	**2**	**3.0**	**4.23**	**3.4**
Average score	**6.0**	**4.9**		**5.9**	**4.65**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded from outside of the survey sections or present in the strandline

Negative indicator species

Crocosmia x crocosmiiflora was observed growing in the marginal habitat at low frequency. This species is listed in Schedule 9 of the Wildlife & Countryside Act (1981) (NNSS, 2015). No other alien or nuisance species were recorded. Filamentous algae cover was moderate, with 9% of all sampling points scoring a '3'.

Macrophyte community structure

Improved grazing/pasture surrounds Lough Anierin to all sides, with an area of coniferous plantation within close proximity north of the lough. Wet woodland forms the majority of the margins to the lough, comprising of *Alnus glutinosa, Juncus acutiflorus, Juncus effusus. Salix* spp. and *Molinia caerulea* as the dominant species. Aquatic emergent vegetation was sparse within the survey, with *E. fluviatile* and *P. australis* dominating the shallows to the south of the lough. *Littorelletea* flora showed clear zonation, with *L. uniflora* abundant in S2 within shallow depths of 25 – 75 cm, while *L. dortmanna* was observed at depths between 50 – 75 cm. *I. lacustris* was occasionally found in deeper waters of 75 – 110 cm. *S. angustifolium* was only recorded to the north of the lough (110 – 140 cm). The floating leaved and submerged flora was dominated by *P. natans,* which extended from the shallows at 25 cm through to the maximum depth of colonisation (Z_v), at 210 cm. By comparison, *P. alpinus* was only recorded a two points in S2, between 100 – 110 cm. Localised beds of *N. flexilis* agg. were recorded within the open waters of S2, at depths of 50 – 100 cm with an occasional abundance, while *C. virgata* was found in shallower waters of 75 - >75 cm at a much lower frequency. *M. alterniflorum* was occasional in depths of 50 – 75 cm of S2, and was intermingled by *F. antipyretica* at similar depths. The current structure is considered to be favourable for a site of this type.

Water quality

Table 98 Water chemistry data for Lough Anierin

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1990
TP	15.9	39.0	43.8	31.8	**32.6**	23
SRP	1.9	2.2	8.9	3.7	**4.2**	16
TN	0.60	0.67	0.79	0.70	**0.69**	0.79
TON	0.005	0.005	0.057	0.077	**0.036**	-
Nitrite	0.001	0.001	0.006	0.001	**0.002**	-
Chl *a*	11.4	9.9	18.0	10.2	**12.4**	7.9
DOC	7.71	8.81	9.68	7.79	**8.50**	-
pH	7.08	7.10	6.98	7.19	**7.08**	7.17
Alk	15	20	19	11	**16.3**	7.9
Cond	83	81	83	98	**86.3**	137
Ca^{2+}	6.30	7.02	7.28	6.49	**6.77**	9.5
Mg^{2+}	1.23	1.30	1.23	1.44	**1.30**	1.85
Na^{+}	8.43	7.88	7.84	10.80	**8.74**	11.6
K^{+}	0.91	0.94	1.06	1.05	**0.99**	1.5
Cl^{-}	15.90	13.90	14.60	20.70	**16.28**	25.39

SO_4^{2-}	<10	3.06	3.45	3.89	**5.10**	8.14

The water chemistry of Lough Anierin is fairly typical for a mesotrophic lough, having a circumneutral pH and ionic concentration. However, the water colour was brown-green and turbid, allowing for light penetration to only 0.85 m. The mean annual concentration for total phosphorus is high, exceeding the target level set in the CSM guidelines for both oligotrophic and mesotrophic lake types (10 and 15 μgl^{-1} respectively, JNCC 2015). However it is recognised that the interaction of nutrients in peaty sites is complex and therefore elevated TP is not always indicative of unfavourable conditions. Filamentous algae was recorded at low levels but most abundant within the wader transects where plant biomass is highest. Chl *a* concentrations were moderate, peaking in early winter. The water chemistry has generally remained consistent since 1990, although direct comparisons must be treated with caution as the 1990 data is based on a summer spot-sample.

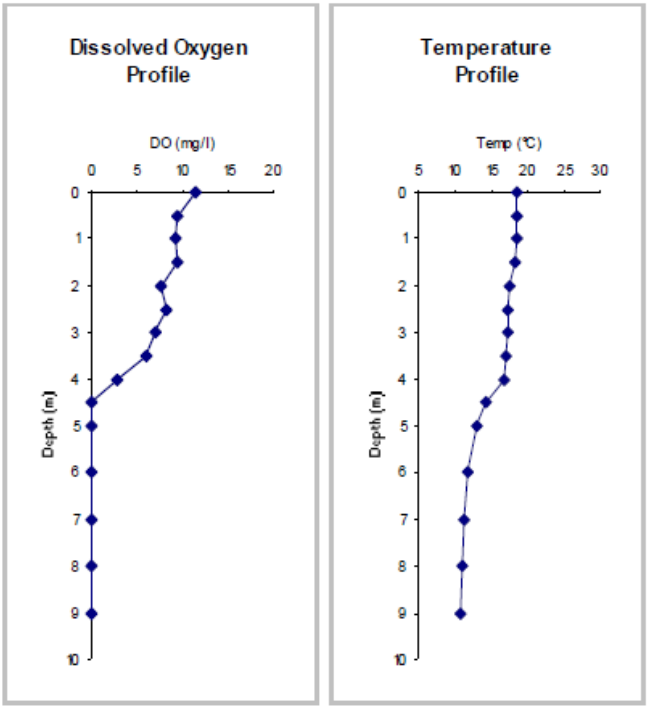
The lake was well oxygenated down to 3.5 m water depth in August 2014 (DO = 6 – 11 mgl^{-1}) but dropped to a mean value of 0.05 mgl-1 below the thermocline. The water quality is not considered favourable for a lake of this type.

Figure 23 Dissolved oxygen and temperature profile for Lough Anierin (07/08/2014)

Dissolved Oxygen Profile

GPS Location	G9955747185
Maximum Depth (m)	9.5 m
Secchi Depth (cm)	85 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	11.3	18.5
0.5	9.4	18.4
1	9.2	18.4
1.5	9.4	18.3
2	7.5	17.6
2.5	8.2	17.3
3	7.01	17.2
3.5	6.01	17
4	2.75	16.7
4.5	0.07	14.3
5	0.03	13
6	0.04	11.8
7	0.03	11.2
8	0.06	10.9
9	0.07	10.7



Hydrology

The hydrological regime at the site appears natural.

Lake substrate

Lough Anierin lies within a peat catchment with exposed bedrock on the eastern shore. Sands dominate the shallows to the open water on the north shore. The

shallow waters of the south shore comprise of root mass and sand, which becomes silty substrates in the open water.

Sediment load

The lough is surrounded by improved grazing and pasture. At the time of survey, grazing was observed and poaching was noted around the lough, which contributed as possible evidence for an increase in sediment load to the lough.

Indicators of local distinctiveness

No indicators of local distinctiveness were recorded either in the 1990 or 2014 surveys. However, otter spraints were observed during the 2014 survey.

Summary

Lough Anierin is classified as an "oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*", but fails to achieve the necessary floristic requirement as defined within the CSM guidance (JNCC 2015) for mesotrophic species. Neither does the lough meet the oligotrophic or mesotrophic species frequency target of >60% of sample plots having one or more characteristic species. Comparison of the 1990 and 2014 survey species data indicates that species diversity has changed very little over the past 24 years, with only one species absent from the recent survey. The water chemistry data to some extent indicates little change in trophic status since 1990, although TP concentrations exceed the target level as set by the CSM guidelines. A combination of observed poaching, turbid water, poor light penetration and unsatisfactory oxygen levels within the water column at the time of survey indicates a level of increased sediment load to the lough, resulting in possible eutrophication. Further monitoring is recommended to fully establish the condition of the lough and to determine whether nutrient enrichment is a problem at this site. The current survey places the lough in **unfavourable condition.**

Table 99 Lough Anierin: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Anierin NI Lake 689	**Unfavourable**	Failed to achieve oligotrophic or mesotrophic species frequency target. Water chemistry fails to achieve SCA targets, with unsatisfactory oxygen levels in water column. Blue-green algae	Good macrophyte community structure. Grazing and poaching observed around the lough, possible contribution to sediment loading and eutrophication. Further monitoring recommended to assess possible impacts of nutrient enrichment.

	observed at time of survey.

Species list

Table 100 List of all plant species recorded at Lough Anierin: 2014

Marginal & Emergent species	Abundance (DAFOR)
Alnus glutinosa	F
Anagallis tenella	R
Angelica sylvestris	R
Caltha palustris	R
Carex sp.	R
Crocosmia spp.	R
Filipendula ulmaria	O
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	F
Juncus effusus	F
Lythrum salicaria	R
Mentha aquatica	R
Mentha sp.	R
Mosses unid	O
Phalaris arundinacea	R
Potentilla erecta	R
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	F
Senecio aquaticus	R
Succisa pratensis	R
Vaccinium myrtillus	R
Submerged & floating species	**% Frequency (n = 58)**
Chara virgata	3.4
Fontinalis antipyretica	15.5
Isoetes lacustris	10.3
Littorella uniflora	17.2
Lobelia dortmanna	8.6
Myriophyllum alterniflorum	6.9
Nitella flexilis agg.	13.8
Nymphaea alba	+
Potamogeton alpinus	3.4
Potamogeton natans	50.0
Sparganium angustifolium	3.4

Survey data

Site Condition Assessment: Anierin Lough (07/08/2014)

Lake Details		**Survey Details**	
Lake Name	Anierin Lough	Survey Date	07/08/2014
SSSI Name		Surveyors	SG, EF
SAC Name		Shore Surveys	2 out of
Grid Ref (centre)	G996472	Wader Surveys	2 2
WBID / NI No.	50216 / 689	Boat Surveys	2 sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	210 cm
		Compass bearing of boat transect (°)	180 °
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	140 cm
		Compass bearing of boat transect (°)	20 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: S2- bank v steep from 0.75m beyond.	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	G9951247104	G9961247108	G9956947103	G9956847116
Section	**2**	G9958847290	G9968947251	G9964247273	G9964547267

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	134-0423	134-0425	134-0426
Section	**2**	134-0427	134-0428	134-0429

3.19. Lough Navar (MA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	4 August 2014
NI Lake Number:	690
WBID:	50044
County:	Fermanagh
Grid reference:	H028548
OS Grid reference (X,Y):	202793,354781
Shoreline development index:	1.399
Surface area (ha.):	27.8
Maximum recorded depth (m):	7.5

Table 101 Condition Assessment Summary Table for Lough Navar.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed	**X**	2 present: *Isoetes lacustris* and *Littorella uniflora*
	Mesotrophic: ≥ 8 characteristic species listed	**X**	4 species.: *I. lacustris, L. uniflora, Nitella flexilis* agg., & *Nitella translucens.*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	*S. angustifolium* was recorded in 1990, as well as two *Potamogeton* spp. (*P. alpinus* & *P. perfoliatus)* and *Nitella confervacea*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	60% of vegetated sample spots comply for oligotrophic species. (64% wader survey & 53% boat survey). 77% of vegetated sample spots comply for mesotrophic species. (82% wader survey & 68% boat survey).
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded with only 1.8% frequency
	Filamentous Algae (non-*Chara)*: <20% of points scoring '3'	**X**	0% of sampling points score '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Coniferous woodland/heathland surrounds lough with sedges and rushes to the margins: *C. diandra, C. nigra, C. rostrata, J. acutiflorus, J. effusus, Salix* spp. and mosses. Limited, patchy emergent vegetation to N and S of lough (*C. rostrata, P. australis, E. fluviatile* & *S. lacustris. Littorelletea* in all sections, dominating S2 & S4. *F. antipyretica* only in S1 & S2 (25-170 cm). *Chara virgata* in localised beds in S1, S2 & S3, between 25-110 cm depth. *Nitella translucens* also in S1, S2 & S3 in shallow depths (50-75 cm). *N. flexilis* only in S3 at 75 cm. *M. spicatum* very occasional in S2 & S3 (25->75 cm) while *E. canadensis* only recorded twice in S1 & S4 (>75 cm). A degree of zonation is evident.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 7.5 m, Z_s = 1.5 m, Z_v = 1.7 m.
	At least the present structure should be maintained	**?**	Previous data insufficient for comparison.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	✓	TP = 10 μgl^{-1} (range 10-11) & TN = 0.42 mgl^{-1} (April '14 – Feb. '15). Favourable for both oligotrophic and mesotrophic

Attribute	Target	Status	Comment
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.2 (range = 7.1 – 7.4).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	✓	Waters well oxygenated and mixed throughout the water column: mean DO value of 9.6 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	None noted
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Appears natural.
	Natural and characteristic substrate maintained	✓	Predominantly peat catchment. Bedrock and boulders in the shallows, then sandy substrate at >75 cm. Sandy beach on E side of lough.
Sediment load	Natural sediment load maintained	✓	No grazing or poaching in the area. Predominantly coniferous plantation – no evidence for increased sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓	Coniferous plantations – no negative impacts observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 28 ha with no loss of extent to the open water.

Macrophyte community composition

Lough Navar lies within a catchment of open heathland and coniferous woodland, underlain by shallow peats and with small areas of exposed bedrock (Carboniferous sandstone/limestone). Two characteristic *Littorelletea* species were recorded within the lough, *Isoetes lacustris* and *Littorella uniflora*. Other characteristic mesotrophic species were *Nitella flexilis* agg. and *Nitella translucens*. Lough Navar does not pass either the mesotrophic or oligotrophic species compositional targets as set in the CSM guidelines (JNCC, 2015). However, it meets the oligotrophic and mesotrophic species frequency target of >60% of sample spots having 1 or more characteristic species, with 60% and 77% and of plots complying respectively.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 6.8 and 5.87 respectively (Table 102). The scores calculated from the 1990 survey data were slightly lower than those from 2014, suggesting that there has been a possible decline in trophic status. Comparison of the 1990 and 2014 survey species list indicates that there have been an apparent loss of species over the past 26 years, or are currently at too low abundance to be detected within the survey. Characteristic species recorded in 1990 but not in 2014 were *Sparganium angustifolium, Potamogeton alpinus, Potamogeton perfoliatus* and

Nitella confervacea, all of which were noted as 'occasional' or 'rare'. Only *Nitella translucens* was recorded as a new species for 2014. The differences between the two survey data could either be attributed to the different survey methods employed in 1990 and 2014, or there has been a genuine shift in the lough's species composition, due to a decline in trophic status. Further investigation is recommended. A full list of species is given in Table 105.

Table 102 Aquatic macrophyte community composition for Lough Navar, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=111)***
Chara spp.	8.5	7.69	4	-	-	-
Chara globularis virgata	8.5	7.69	+	-	-	-
Chara virgata	**-**	**-**	**-**	8.5	7.69	17
Elodea canadensis	8.5	7.95	3	8.5	7.95	2
Fontinalis antipyretica	6.3	5.38	2	6.3	5.38	13
Isoetes lacustris	**5.0**	**4.23**	**1**	**5.0**	**4.23**	**49**
Littorella uniflora	**6.7**	**4.23**	**3**	**6.7**	**4.23**	**14**
Mosses unid	-	-	2	-	-	2
Myriophyllum alterniflorum	5.5	4.23	3	-	-	-
Myriophyllum spicatum	-	-	-	10.0	8.85	9
Nitella confervacea	**5.5**	**5.38**	**+**	**-**	**-**	**-**
Nitella flexilis	**5.5**	**5.38**	**+**	**5.5**	**5.38**	**3**
Nitella flexilis agg.	**-**	**-**	**-**	**5.5**	**5.38**	**1**
Nitella translucens	**-**	**-**	**-**	**5.5**	**5.38**	**25**
Potamogeton alpinus	**5.5**	**5.38**	**2**	**-**	**-**	**-**
Potamogeton obtusifolius	7.3	6.54	1	-	-	-
Potamogeton perfoliatus	**7.3**	**7.69**	**2**	**-**	**-**	**-**
Potamogeton natans	-	-	-	6.7	4.23	+
Sparganium angustifolium	**3.0**	**4.23**	**1**	**-**	**-**	**-**
Average score	**6.4**	**5.85**		**6.8**	**5.87**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes a species recorded from outside the survey sections or present in the strandline

Negative indicator species

Elodea canadensis was recorded at the site with only a 1.8% frequency and an abundance of '1' ('rare' on a 1-5 scale). This is an improvement to the 1990 survey data, where the species was recorded as a '3' ('frequent' on a 1-5 scale). The presence of this non-native species in unfavourable within the CSM guidelines (JNCC 2015). No other alien or nuisance species were recorded from the site and filamentous algae cover was low.

Macrophyte community structure

The majority of Lough Navar is surrounded by coniferous forest, with pockets of heathland to the south and east of the lake. Sedges and rushes dominate the margins, primarily *Carex diandra, Carex nigra, Carex rostrata, Juncus acutiflorus* and *Juncus effusus,* with the occasional *Salix* spp. and various unidentified mosses. Limited, patchy emergent vegetation was recorded to the north and south of the lough, comprising of *C. rostrata, Phragmites australis, Equisetum fluviatile* and *Schoenoplectus lacustris. Littorelletea* flora was recorded in all sections, particularly dominating S2 and S4. *Fontinalis antipyretica* grew sparsely in water depths of 25 – 170 cm, in S1 and S2 only. Localised beds of *Chara virgata* were found in all sections except east of the lough, between 25 – 110 cm depth at low frequency. *Nitella translucens* was also found in these regions, but at shallower depths of 50 – 75 cm. Only one instance of *Nitella flexilis* was recorded, towards the north shore of the lough at 75 cm. *Myriophyllum spicatum* appeared very occasionally in S2 and S3, also in shallow waters of 25 - >75 cm. *Elodea canadensis* was recorded only on two occasions, in S1 and S4 apiece, at >75 cm depth. The current structure is considered to some extent to be favourable for a site of this type.

Water quality

Table 103 Water chemistry data for Lough Navar

	Apr '14	Aug. '14	Nov. '14	Feb. '14	Mean	1990
TP	11.2	10.2	10.0	10.3	**10.4**	23
SRP	1.8	<1.0	1.7	2.4	**<1.7**	9
TN	0.52	0.43	0.38	0.35	**0.42**	0.25
TON	0.016	0.006	0.013	0.029	**0.016**	-
Nitrite	0.002	0.001	0.001	0.001	**0.001**	-
Chl *a*	13.05	1.7875	3.30	1.65	**4.95**	3.76
DOC	8.37	7.77	8.30	9.37	**8.45**	-
pH	7.33	7.35	7.16	7.14	**7.23**	7.37
Alk	9	5	10	10	**8.5**	6.1
Cond	73	74	74	86	**77**	173
Ca^{2+}	1.04	4.53	4.74	3.93	**3.56**	4.44
Mg^{2+}	0.40	1.65	1.63	1.71	**1.35**	1.92
Na^{+}	2.12	8.38	8.29	10.40	**7.30**	1.58
K^{+}	0.13	0.41	0.40	0.40	**0.33**	0.02
Cl^{-}	16.20	15.20	15.20	19.60	**16.55**	19.9
SO_4^{2-}	<10	3.19	3.28	4.08	**<5.14**	5.79

The water chemistry of Lough Navar is fairly typical for a mesotrophic lough, having a circumneutral pH and ionic concentration. Although the water clarity was peaty brown throughout the lough, light penetration reached to 1.5 m. Total phosphorus concentrations were consistent throughout the year and on average remained below the target level set in the CSM guidelines for both the oligotrophic and mesotrophic

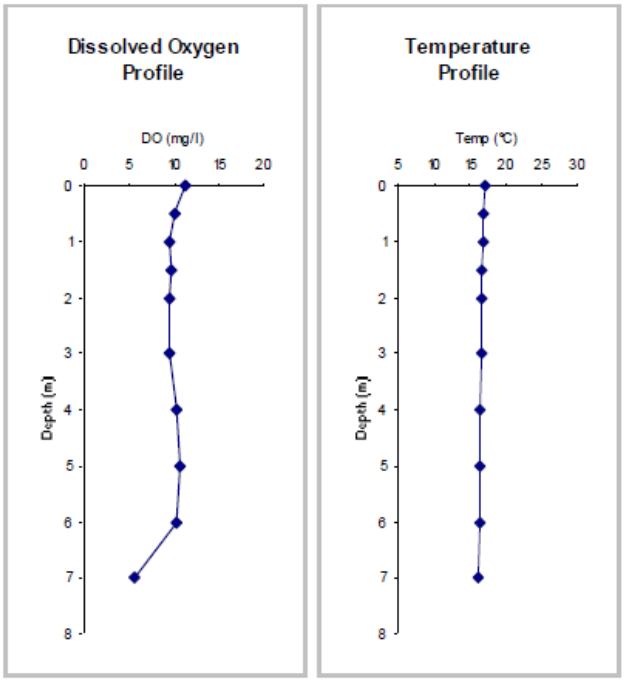
lake types (10 and 15 μgl^{-1} respectively, JNCC 2015). Total nitrogen was low and the lough shows limited direct evidence of the effects of nutrient enrichment. Chl *a* concentrations on average remained low, peaking in spring 2014. The lake was well oxygenated and mixed throughout the water column at the time of survey, with a mean DO value of 9.6 mgl^{-1}.

Figure 24 Dissolved oxygen and temperature profile for Lough Navar (04/08/2014)

Dissolved Oxygen Profile

GPS Location	H0277754774
Maximum Depth (m)	7.5 m
Secchi Depth (cm)	150 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	11.35	17.1
0.5	10.07	17
1	9.6	16.8
1.5	9.7	16.7
2	9.5	16.6
3	9.5	16.6
4	10.2	16.5
5	10.6	16.4
6	10.2	16.3
7	5.7	16.2



Hydrology

Lough Navar is connected via a short stream to Lough Naman, a very small water body to the west of Navar. The hydrological regime at the site appears natural.

Lake substrate

Lough Navar is situated in a predominantly peat catchment, with underlying Carboniferous sandstone and limestone (DOENI, 2012). The shallows comprise of bedrock and boulders, while sandy substrate predominates in the open waters from depths of >75 cm. A sandy beach is situated on the east side of the lough.

Sediment load

No grazing or poaching was observed in the area at the time of survey. The lough is surrounded predominantly by coniferous plantation; there was no evidence for increased sediment load.

Indicators of local distinctiveness

No indicators of local distinctiveness were recorded either in the 1990 survey or the recent 2014 survey.

Summary

Lough Navar is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”, but fails at some levels to achieve the necessary floristic requirement as defined within the CSM guidance (JNCC 2015) for either oligotrophic or mesotrophic species. Comparison between the 1990 and 2014 survey species data indicates that four characteristic species were absent from the lough during the recent survey, although there is a possibility that they are present but at too low abundance to be detected within the transects. The nature of the survey methods between 1990 and 2014 were also very different and so direct comparison and subsequent conclusions must be made with caution. Frequency of occurrence of mesotrophic characteristic species within the vegetated sample plots was high however, comfortably meeting the CSM guidelines of >60% occurrence. The water chemistry data suggests favourable conditions and appear to have improved since the spot water sample that was analysed in 1990. Although further monitoring is recommended to establish the presence of the absent characteristic species as recorded in 1990, the current survey places the lough in **favourable condition.**

Table 104 Lough Navar: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Navar NI Lake 690	**Favourable**		Does not achieve minimum number of characteristic species for either oligotrophic or mesotrophic lake type. *E. canadensis* frequency has decreased since 1990; water chemistry is favourable and has improved since 1990. Further monitoring recommended to establish presence of characteristic species recorded in 1990 but not 2014.

Species list

Table 105 List of all plant species recorded at Lough Navar: 2014

Marginal & Emergent species	Abundance (DAFOR)
Angelica sylvestris	R
Calluna vulgaris	F
Caltha palustris	R
Carex diandra	R
Carex nigra	R
Carex rostrata	R
Eleocharis palustris	O
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum fluviatile	O
Euphrasia nemorosa	R
Galium palustre	R
Hypericum pulchrum	R
Juncus acutiflorus	F
Juncus effusus	R
Lotus corniculatus	R
Mosses unid	O
Phalaris arundinacea	R
Potentilla reptans	R
Ranunculus flammula	R
Salix sp.	O
Scutellaria galericulata	R
Senecio aquaticus	R
Sphagnum sp.	R
Stachys palustris	R
Succisa pratensis	R
Veronica beccabunga	R
Submerged & floating species	**% Frequency (n = 111)**
Chara virgata	17
Elodea canadensis	2
Fontinalis antipyretica	13
Isoetes lacustris	49
Littorella uniflora	14
Myriophyllum spicatum	9
Nitella flexilis	3
Nitella flexilis agg.	1
Nitella translucens	25
Potamogeton natans	+

Survey data

Site Condition Assessment: Navar Lough (04/08/2014)

Lake Details		**Survey Details**		
Lake Name	Navar Lough	Survey Date	04/08/2014	
SSSI Name		Surveyors	SG, EF	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	H028548	Wader Surveys	4	4
WBID / NI No.	50044 / 0	Boat Surveys	4	sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	170 cm
		Compass bearing of boat transect (°)	225 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	150 cm
		Compass bearing of boat transect (°)	170 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**3**	Maximum depth of colonisation (cm)	140 cm
		Compass bearing of boat transect (°)	350 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	
Section	**4**	Maximum depth of colonisation (cm)	120 cm
		Compass bearing of boat transect (°)	90 °
		Lateral distance from waters edge to 75cm depth (m)	8 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0255754855	H0250354916	H02551354873	H0256254897
Section	**2**	H0283354616	H0274254575	H0280854575	H0277454643
Section	**3**	H0287854951	H0296955001	H0292854979	H0292854943
Section	**4**	H0320854866	H0317954770	H0321254810	H0318254820

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	131-0381	131-0380	131-0384
Section	**2**	131-0385	131-0386	131-0387
Section	**3**	131-0388	131-0390	131-0389
Section	**4**	131-0392	131-0393	131-0397

3.20. Derrynacarbit Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	05 August 2014
NI Lake Number:	694
WBID:	50203
County:	Fermanagh
Grid reference:	H005507
OS Grid reference (X,Y):	200473, 350666
Shoreline development index:	1.179
Surface area (ha.):	6.5
Maximum recorded depth (m):	3.3

Table 106 Condition Assessment Summary Table for Derrynacarbit Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	**X**	No *Littorelletea* species – only *Sparganium angustifolium*
	Mesotrophic: ≥ 8 Characteristic species	**X**	1 characteristic species present; *Sparganium angustifolium*
	No loss of characteristic species	**X**	Loss of 4 oligotrophic species; *L. uniflora, I. lacustris, L. dortmanna, M. alterniflorum* and 1 mesotrophic specis; *P. alpinus* since the 1989 NILS survey.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	12% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	*Elodea canadensis* not recorded although present in 1989.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Very little filamentous algae recorded (mostly 1s).
Macrophyte community structure	Characteristic vegetation zones shou be present	**X**	At the time of the survey the water level was raised due to recent heavy rains, much of the 25 and 50 cm sample plots contained submerged terrestrial species. A thin fringe of emergent vegetation consisting of mainly C*. rostrata and occasional P.australis, S. lacustris* and *E. fluviatile.* Other taxa in the 25-50cm plots included; *C. palustris*, *H. vulgaris*, J. *acutiflorus, J. effusus, M. gale* and P*. palustris*, although given the raised water level it was difficult to discern if these taxa truly inhabited these depths under normal water levels. Beyond the marginal fringe the only submerged macrophyte recorded was F. antipyretica and this appeared to by 'dying off' at depths between 1.7 - 2.3m. Other macrophytes in this zone included P. natans and N. alba.
	Maximum depth distribution should be maintained	✓	Z_{max} = 3.3 m, Z_s = 1.8 m, Z_v = 2.4 m.
	At least the present structure should be maintained	**✓?**	Although no comparable data. Loss of isoetid species would suggest a reduction in Z_v
Water quality	Stable nutrients levels: TP target / limit: Mesotrophic = 15 μgl^{-1}	**X**	TP = 53.3 μgl^{-1} (range 21-78) & TN = 0.91 mgl^{-1} (April '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.84 (range = 6.7 – 7.3).
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	✓	Waters well oxygenated: DO >6.3 mgl^{-1} >3 m. No thermocline

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	X	Blue green algal bloom visible within the water column and forming occasional surface scum.
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of peat and silt substrates at the margins, with occasional boulders and cobbles. Predominantly silt in deeper water (>0.75m).
Sediment load	Natural sediment load maintained	✓?	Forestry surrounds the lough with recent clearfell to the east of the lough. These operations can add to the sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	X	No isoetid species recorded. 3 species present in the 1980's.
	Minimal negative impacts and no fish farming	X?	Forestry

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 6.5 ha, with no loss of extent of open water.

Macrophyte community composition

Derrynacarbit Lough has a poor diversity of macrophyte taxa with this survey recording 6 aquatic species, only 1 of which was a characteristic species; *Sparganium angustifolium*. No Isoetid species were recorded nor were there any characteristic broadleaved *Potamogeton* species. The only *Potamogeton* species recorded was *P. natans*, which has a broad range of habitat preferences. *Fontinalis antipyretica* was the only submerged macrophyte taxa recorded. Small patches of *Nymphaea alba* were also recorded. Species in the marginal fringe included *Carex rostrata, Phragmites australis, Schoenoplectus lacustris, Potentilla palustris* and *Hydrocotyle vulgaris,* many of which were submerged due to high water levels.

The NI lake survey (NILS) recorded a very different set of species at Derrynacarbit Lough as the current survey. All Isoetid species appear to have been lost from the lough which are key components of the macrophyte flora of an oligotrophic to mesotrophic lough. The NILS survey recorded; *Littorella uniflora, Isoetes lacustris, Lobelia dortmanna, Myriophyllum alterniflorum, Potamogeton alpinus, Juncus bulbosus, Elodea canadensis* and Charophytes, all of which were absent in the current survey. Species present in both surveys were; *N. alba, P. natans, S. angustifolium* and *F. antipyretica*. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are almost identical to those calculated from the NILS 1989 data, this however demonstrates the limitations of these metrics as the macrophyte community has clearly changed significantly in that time.

Table 107 Aquatic macrophyte community composition for Derrynacarbit Lough, including trophic scores

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=83)***
Charophytes	8.5	7.69	2	-	-	-
Elodea canadensis	8.5	7.95	1	-	-	-
Fontinalis antipyretica	6.3	5.38	5	6.3	5.38	34.5
Isoetes lacustris	**5.0**	**4.23**	**2**	**-**	**-**	**-**
Juncus bulbosus	3.7	3.08	3	-	-	-
Lemna minor	9.0	8.85	2	9.0	8.85	5.4
Littorella uniflora	**6.7**	**4.23**	**4**	**-**	**-**	**-**
Liverworts aquatic	-	-	1	-	-	-
Lobelia dortmanna	**5.0**	**3.08**	**4**	**-**	**-**	**-**
Menyanthes trifoliata	-	-	-	5.3	-	9.6
Mosses aquatic	-	-	1	-	-	-
Myriophyllum alterniflorum	5.5	4.23	2	-	-	-
Nymphaea alba	6.7	3.08	2	6.7	3.08	12
Potamogeton natans	6.7	4.23	3	6.7	4.23	19.3
Potamogeton alpinus	**5.5**	**5.38**	**2**	**-**	**-**	**-**
Sparganium angustifolium	**3.0**	**4.23**	**1**	**3.0**	**4.23**	**12**
Average score	**6.2**	**5**		**6.2**	**5.2**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Negative indicator species

Elodea canadensis was recorded in the 1989 NILS survey but was not recorded in the current survey. There appears to be a loss of submerged macrophytes at this site so this doesn't necessarily represent an improvement.

Macrophyte community structure

Derrynacarbit Lough is surrounded by coniferous forest plantations with recent clearfell of surrounding forests apparent at the time of survey. The natural vegetation of the catchment is blanket bog which has been much fragmented by forestry, drainage and peat cutting.

The lough is bordered by a thin reed fringe consisting of *S. lacustris P. australis* and *C. rostrata. E. fluviatile* is also common in this fringe. At the time of survey water levels were high so many marginal plants were recorded in the 25 -50 cm sections. The only submerged macrophyte taxa was *F. antipyretica* which was present between 1-2.2m depth. Occasional patches of *P. natans* and *N. alba* occurred up to 1.7m depth.

Water quality

Derrynacarbit Lough is a shallow (Z_{max} recorded = 3.3 m) lake with an annual mean TP (53.3 µgl-1) which is above the guideline levels for both oligotrophic (10 µgl-1) and mesotrophic (20 µgl-1) lakes (JNCC 2015) and classifies it as "unfavourable" with respect to trophic status. DOC levels were high which reflects the peat catchment and forestry operations, such as clearfell, which can elevate DOC levels (Drinian et al. 2013) Very little filamentous algae was recorded but blue-green algae was present in the water column throughout the lough, forming surface scums in places. Chlorophyll a levels were moderately high. The water chemistry data from a one off spot sample collected as part of the NILS programme is similar to the most recent data. The TP is high and chlorophyll a levels are exceptionally high. This suggests that the catchment has been suffering from increased nutrient inputs for sometime. The water column was well oxygenated (> 6.3 mgl-1) at all depths (Figure 25)

Table 108 Water chemistry data for Derrynacarbit Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1989
TP	57	20.8	79.5	55.7	53.3	52
SRP	9.3	3.7	27.6	26.3	16.7	3
TN	0.96	0.93	0.91	0.82	0.91	1.25
TON	<0.005	0.005	0.111	0.174	<0.074	-
Nitrite	0.003	<0.001	0.002	0.001	<0.002	-
Chl *a*	26.2	3.8	9.0	4.6	9.1	135.9
DOC	13.4	34.6	15.3	12.6	18.9	-
pH	7.31	6.74	6.84	6.7	6.84	7.79
Alk	14	23	14	9	15	8.5
Cond	99	65	90	107	90	114
Ca^{2+}	6.14	7.1	6.94	6.35	6.6	6.86
Mg^{2+}	1.4	1.54	1.24	1.54	1.43	1.86
Na^{+}	10.7	7.24	9.87	12.8	10.15	7.28
K^{+}	1.12	0.151	0.898	0.849	0.75	0.1
Cl^{-}	22.4	12.2	18.8	24.2	19.4	21.1
SO_4^{2-}	<10	2.02	3.54	5.29	<5.21	5.3

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty

Sediment load

The dominant land cover in the catchment is conifer forest plantation and blanket bog. At the time of the survey clearfell of some of the forested areas was noted.

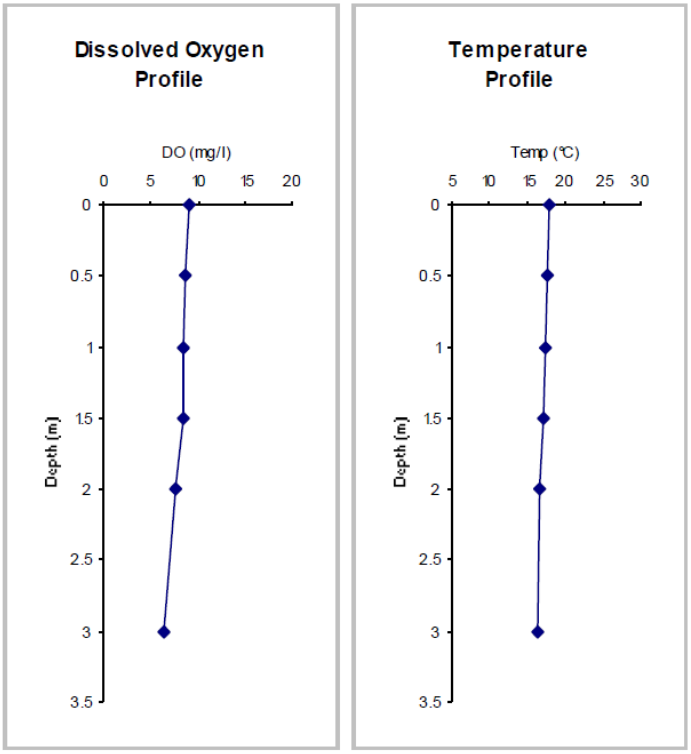
Clearfell operations are known to increase the sediment load and impact other water quality parameters (Duigan *et al.* 2013*).* Given the distinct change in the macrophyte flora of Derrynacarbit Lough from an Isoetid dominated flora in the 1980's to one devoid of submerged macrophytes in its current state an increase in sediment load may have contributed to this community change.

Figure 25 Dissolved oxygen and temperature profile for Derrynacarbit Lough (05/08/2014)

Dissolved Oxygen Profile

GPS Location	H0044550667
Maximum Depth (m)	3.3 m
Secchi Depth (cm)	180 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.97	17.8
0.5	8.73	17.6
1	8.4	17.3
1.5	8.37	17.1
2	7.56	16.5
3	6.3	16.3



Indicators of local distinctiveness

None noted

Summary

Derrynacarbit lough was in a poor state at the time of the survey in 2014. The lake is classed as oligotrophic to mesotrophic but with only 1 characteristic mesotrophic species recorded (*S. angustifolium*) in 12% of submerged sample plots the lake does not have a characteristic flora normally associated with these lake types. Historically (NILS) the lake has supported a good diversity of oligotrophic to mesotrophic species such as *I. lacustris*, *L. uniflora*, *L. dortmanna* and *M. alterniflorum*. A clear change has occurred since the 1989 NILS survey which has negatively impacted the lakes flora. Given the catchment is dominated by forestry it is likely that this is the cause of the ecological change. A study by Drinan (2013) concluded that the clearfell of forests within a peatland catchment caused an increase in phosphorous, nitrogen, total dissolved organic carbon, aluminium and iron, all factors that can alter the ecology of a lake. The water chemistry of Derrynacarbit Lough showed high levels of TP, TN and DOC concurring with Drinan's study. An increase in sediment load may also have occurred due to recent clearfell near the lake. A blue green algal bloom

was noted at the time of survey, perhaps another symptom of increased nutrient loading caused by forest clearfell. Due to the above factors Derrynacarbit Lough is classed as being in an **Unfavourable** condition. The shift in macrophyte community from the NILS survey to today is quite dramatic and this report recommends that this lake should be monitored further to identify the exact cause of change and attempt to remediate the effects where possible.

Table 109 Derrynacarbit Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Derrynacarbit Lough NI Lake 694	**Unfavourable**	Only 1 characteristic species present at low frequency. Blue green algal bloom at time of survey. TP levels high. Loss of characteristic flora since the NILS survey.	Lake in poor condition, further monitoring recommended.

Species list

Table 110 List of all plant species recorded at Derrynacarbit Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Equisetum fluviatile	F
Carex rostrata	O
Hydrocotyle vulgaris	O
Juncus acutiflorus	O
Myrica gale	O
Phragmites australis	O
Schoenoplectus lacustris	O
Myosotis laxa	R
Salix sp.	R
Potentilla palustris	R
Caltha palustris	R
Ranunculus flammula	R
Senecio aquaticus	R
Succisa pratensis	R
Carex nigra	R
Calluna vulgaris	R
Angelica sylvestris	R
Juncus effusus	R
Lychnis flos-cuculi	R
Galium palustre	R
Menyanthes trifoliata	R
Veronica catenata	R
Carex paniculata	R
Submerged & floating species	**% Frequency (n = 83)**
Fontinalis antipyretica	35
Lemna minor	5
Menyanthes trifoliata	10
Nymphaea alba	12
Potamogeton natans	19
Sparganium angustifolium	12

Survey data

Site Condition Assessment: Derrynacarbit Lough (05/08/2014)

Lake Details		**Survey Details**		
Lake Name	Derrynacarbit Lough	Survey Date	05/08/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H005507	Wader Surveys	3	3
WBID / NI No.	50203 / 694	Boat Surveys	3	sections

Site Notes:

Survey Notes:
Raised water level, Salix & Bog myrtle under water.
Boat Survey: Fontinalis at depths 2.3-1.7m seems to be dying off, perhaps due to blue-green algal bloom.
Difficult to survey, flooded margins, many terrestrial plants submerged.

Section Summaries

Section 3	Maximum depth of colonisation (cm)	210 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	3 m
	Notes: no compass	
Section 2	Maximum depth of colonisation (cm)	240 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	3 m
	Notes: no compass	
Section 1	Maximum depth of colonisation (cm)	240 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	2 m
	Notes: no compass	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 3	H0064250666	H0664150568	H0067250625	H0059950618
Section 2	H0038750774	H0048556764	H0043950766	H0042650691
Section 1	H0039150568	H0031750638	H0034750600	H0039850649

Section Photos

	Start of Section	Whole Section	End of Section
Section 3	0181	0182	0183
Section 2	0163	0164	0165
Section 1	0160	0162	0161

3.21. Lough Doo 697 (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	06 August 2014
NI Lake Number:	697
WBID:	50328
County:	Fermanagh
Grid reference:	H039505
OS Grid reference (X,Y):	203857,350511
Shoreline development index:	1.47
Surface area (ha.):	3.6
Maximum recorded depth (m):	7.3

Table 111 Condition Assessment Summary Table for Lough Doo.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓	3 present: *Isoetes lacustris*, *Lobelia dortmanna, Sparganium angustifolium*.
	Mesotrophic: ≥ 8 other characteristic species	**X**	No *Potamogeton* spp. recorded. 3 characteristic species present: *Isoetes lacustris*, *Lobelia dortmanna, Sparganium angustifolium*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	*Littorella uniflora* recorded in 1990 but not 2014.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	37% of vegetated sample spots comply for oligotrophic species. (43% wader survey, 28% boat).
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	**X**	37% of survey plots scoring 3 for filamentous algae
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Moorland/heath, dominated by *Calluna vulgaris,* surrounds much of the lough, with patches of coniferous forest to the SW and NE of the lough. Fringing emergent vegetation is patchy to non-existent: *P. australis* rare in both sections (>75-115 cm); *C. panicea* and *C. rostrata* rare in S1, at 25 cm. Typical zonation of *Littorelletea* flora. Beds of *Chara virgata* (>75-230 cm) and occasional *J. bulbosus* (>75 cm). *M. alterniflorum* only in S1, 50 – >75 cm. *P. obtusifolius* at 250 cm, S1. No plants beyond 250 cm.
	Maximum depth distribution should be maintained	**X?**	Z_{max} = 7.3 m, Z_s = 1.1 m, Z_v = 2.5 m.
	At least the present structure should be maintained	**-**	Previous data insufficient for comparison.
Water quality	Stable nutrients levels: TP target / limit: oligotrophic = 10 µgl^{-1}	✓	TP = 9.4 µgl^{-1} (range 7-12) & TN = 0.43 mgl^{-1} (April '14 – Feb. '15). Favourable for oligotrophic
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.7 (range = 6.6 – 6.9).
	Adequate dissolved O2 throughout the water column (mean > 7 mgl-1 below thermocline)	✓	Waters well oxygenated through photic zone (DO >8 mgl^{-1} from 0–4m, dropping to 0.8 mgl^{-1} by 7 m). No distinct thermocline therefore average DO 7.8 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	None noted.
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	✓	Predominantly peaty catchment. Marginal substrates mixed, consisting mainly of pebbles and cobbles. Sands in the open water
Sediment load	Natural sediment load maintained	✓	Some poaching observed. No grazing at time of survey. No evidence of impact.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓	Some poaching observed. Coniferous plantation/logging around the lough. Impacts uncertain.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 3.6 ha with no loss of extent to the open water.

Macrophyte community composition

Lough Doo lies within a catchment of shallow peats and small areas of exposed limestone bedrock. At the time of survey, the water was clear but peaty brown in colour, allowing for light penetration of up to 1.1 m, with the aquatic vegetation extending to a depth of 2.5 m. In 2014, a total of 30 macrophyte species were recorded from the lough, including 8 submerged and floating-leaved aquatics. The *Littorelletea flora*, which is often found in distinct zones in oligotrophic loughs was present in Lough Doo - characteristic *Littorelletea* species were *Isoetes lacustris and Lobelia dortmanna.*. *Littorella uniflora* was recorded in 1990, with only an abundance of '2' (on a 1-5 scale), while it was absent from the survey in 2014. It is possible that the species was simply missed from the survey if it still occurs with such low frequency. No other characteristic mesotrophic species were recorded. Other submerged and floating-leaved aquatic species recorded form the lough, at varying abundances were: *Chara virgata, Juncus bulbosus, Myriophyllum alterniflorum, Potamogeton obtusifolius* and *Cladium mariscus.* The marginal emergent vegetation was sparse and at times non-existent, consisting predominantly of *Phragmites australis* and on the southeast edge of the lough, *Carex panicea* and *Carex rostrata.*

The majority of the species were recorded in low abundance, which means that coverage of characteristic species over vegetated sample spots was low, with only 38% of sample spots complying for oligotrophic species.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 5.4 and 4.73 respectively (Table 112). The TRS score and the PLEX score calculated from the 1990 survey data were similar, suggesting that the trophic status of the lough has remained stable over the past 26 years. The species lists from both surveys are highly comparable, although a few minor differences can be noted. *Potamogeton natans* was recorded with a very low abundance of '1' on the NILS 1990 survey, while absent from the 2014 survey. Although the two surveys

cannot be directly compared due to the different surveying methods employed, it is possible that *P. natans* is still within the lough at very low abundance and simply did not feature on the 2014 survey, or it has declined altogether over the past two decades. *M. alterniflorum* and *J. bulbosus* are new additions to the species list, along with *P. obtusifolius.* Given the species' low abundances, it is possible that they were simply missed from the 1990 survey.

Table 112 Aquatic macrophyte community composition for Lough Doo, including trophic scores.

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=87)***
Charophytes	8.5	7.69	1	-	-	-
Chara virgata	-	-	-	8.5	7.69	54
Fontinalis antipyretica	6.3	5.38	2	-	-	-
Isoetes lacustris	**5.0**	**4.23**	**4**	**5.0**	**4.23**	**27**
Juncus bulbosus	-	-	-	3.7	3.08	22
Littorella uniflora	6.7	4.23	2	-	-	-
Lobelia dortmanna	**5.0**	**3.08**	**4**	**5.0**	**3.08**	**15**
Myriophyllum alterniflorum	-	-	-	5.5	4.23	12
Potamogeton obtusifolius	-	-	-	7.3	6.54	2
Potamogeton natans	6.7	4.23	1	-	-	-
Sparganium angustifolium	**3.0**	**4.23**	**2**	**3.0**	**4.23**	**2**
Average score	**5.9**	**4.73**		**5.4**	**4.73**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded from outside the survey sections or present in the strandline.

Negative indicator species

No alien or nuisance species were recorded from the site. However, filamentous algae was generally quite high, recorded within 48% of the wader survey spots and 63% of the boat survey spots.

Macrophyte community structure

Moorland and heath surrounds much of the lough, which is dominated by a community of *Calluna vulgaris, Erica tetralix, Juncus conglomeratus, Juncus effusus,* various moss species and *Sphagnum* spp. Fringing emergent vegetation is patchy to non-existent along the rocky shore, with *Phragmites australis* recorded intermittently in depths of >75 – 115 cm. *Carex rostrata* and *Carex panicea* was interspersed at low abundances to the southeast of the lough at a depth of 25 cm. Lough Doo shows typical zonation of *Littorelletea* flora, although *L. uniflora* was absent from the survey. *L. dortmanna* was recorded occasionally at depths between >75 cm – 120 cm, while *I. lacustris* was found at greater depths of 120 – 200 cm. Occasional beds of *Chara virgata* were observed (>75 – 230 cm), often isolated from other aquatic plant

species. *Juncus bulbosus* and *Myriophyllum alterniflorum* are additional species to the lough since the 1990 survey; frequencies were 22% and 12% respectively. This is less than the SCA upper limit of 40% frequency of occurrence, beyond which the lough would have been considered unfavourable (JNCC 2015). One *Potamogeton* species was recorded, *P. obtusifolius,* at 250 cm depth in S1. No plants were recorded beyond this depth. The current structure is considered favourable for a site of this type.

Water quality

Table 113 Water chemistry data for Lough Doo

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1990
TP	8.1	7.2	11.9	10.3	**9.4**	15
SRP	1.0	1.0	1.9	3.5	**1.9**	6
TN	0.31	0.41	0.50	0.48	**0.43**	0.46
TON	0.04	0.09	0.04	0.07	**0.06**	-
Chl *a*	1.54	2.75	1.37	0.66	**1.58**	4.78
DOC	6.74	8.33	10.10	8.98	**8.54**	-
pH	6.81	6.86	6.70	6.58	**6.72**	6.85
Alk	<5	8	7	<5	**<6.3**	3.6
Cond	65	62	62	71	**65**	103
Ca^{2+}	2.63	3.00	3.08	2.59	**2.83**	3.34
Mg^{2+}	1.44	1.52	1.46	1.49	**1.48**	1.9
Na^{+}	8.31	7.48	7.61	8.82	**8.06**	8.5
K^{+}	0.38	0.38	0.51	0.77	**0.51**	0.22
Cl^{-}	16.10	14.10	13.60	17.50	**15.33**	19.46
$SO4^{2-}$	<10	2.76	2.99	3.35	**<4.78**	5.3

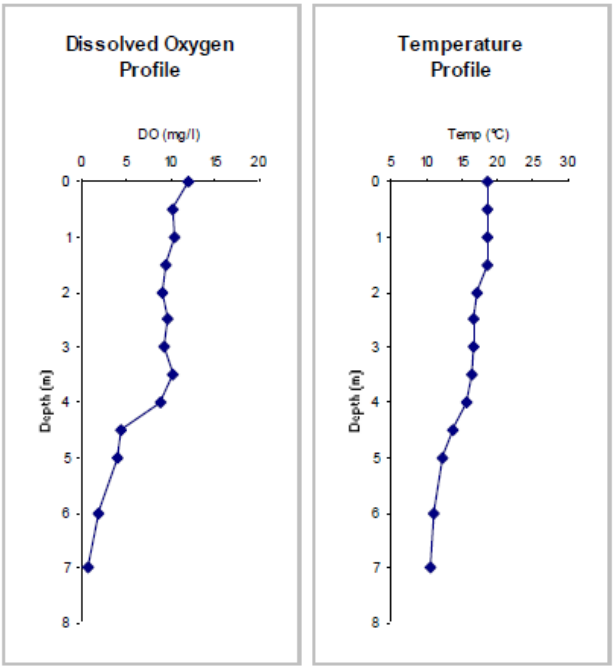
The water chemistry of Lough Doo is fairly typical for an oligotrophic lough, having a circumneutral pH value (6.7) and low ionic concentrations. Total phosphorus concentrations are consistently low throughout the year, remaining below the target level set in the CSM guidelines for shallow oligotrophic lake types (10 μgl^{-1}, JNCC 2015), however it is recognised that the interaction of nutrients in peaty sites is complex and therefore elevated TP is not always indicative of unfavourable conditions. Total nitrogen was low but the lough is showing subtle signs of nutrient enrichment: filamentous algae cover was high and two species indicative of eutrophication at high frequencies were recorded, *J. bulbosus* and *M. alterniflorum.* However, their abundances were low which means there is currently little cause for concern. Monitoring would be advised however to ensure frequencies did not increase. Otherwise, Chl *a* concentrations remained very low. The lough was well oxygenated throughout the photic zone at the time of survey in August 2014 (8 – 12 mgl^{-1} from 0–4 m, dropping to 4.4 mgl^{-1} at 4.5 m and then declining to 0.8 mgl^{-1} at 7 m depth).

Figure 26 Dissolved oxygen and temperature profile for Lough Doo (06/08/2014)

Dissolved Oxygen Profile

GPS Location	H0388950535
Maximum Depth (m)	7.3 m
Secchi Depth (cm)	1.1 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	12	18.6
0.5	10.2	18.6
1	10.5	18.6
1.5	9.52	18.5
2	9.2	17.1
2.5	9.8	16.7
3	9.24	16.6
3.5	10.35	16.4
4	8.89	15.8
4.5	4.4	13.8
5	4.12	12.3
6	2	11.1
7	0.8	10.7



Hydrology

Lough Doo is a fairly small lough with an outflow stream to the northeast, which feeds into nearby Tullywannia Lough. From there, the stream eventually joins Glen River which discharges into Lough Melvin. The hydrological regime at the site appears natural.

Lake substrate

Lough Doo is situated within a catchment which is predominantly peaty. Marginal substrates are mixed, consisting mainly of pebbles and cobbles. Substrates in the open water are sandy.

Sediment load

The lough is surrounded by heathland and forestry. Some evidence for poaching was observed although there was no direct evidence of increased sediment load to the site and the abundance of *J. bulbosus* was not sufficient to suggest a significant impact.

Indicators of local distinctiveness

None specified.

Summary

Lough Doo is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”. The lough meets the floristic compositional targets defined with the CSM guidance (JNCC 2015) for oligotrophic status, supporting two *Littorelletea* species (*L. dortmanna and I. lacustris)* and *S. angustifolium*, but these species occur at low

frequency. The lough is characteristically species poor with low alkalinity levels and low nutrient concentrations. Comparison of the 1990 and 2014 species lists and TRS/PLEX scores suggests that there has been little change in species composition over the last 26 years, particularly in relation to the dominant species. However it must be remembered that the survey methods employed in 1990 and 2014 were very different and so therefore cannot produce directly comparable results. Two species which are usually an indication of unfavourable status in an oligotrophic lough were recorded for the first time in 2014: *J. bulbosus* and *M. alterniflorum.* Their low frequencies are currently not a cause for concern, but regular monitoring of their growth, along with the extent of filamentous algae, is recommended for the purposes of possible nutrient enrichment. The lough is currently in **unfavourable** condition.

Table 114 Lough Doo: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Doo NI Lake 697	**Unfavourable**	Low frequency of characteristic species	A reasonable example of an oligotrophic lough, with low nutrient levels and good floristic composition. Low frequency of the characteristic species is however of concern and levels of *J. bulbosus* and *M. alterniflorum* may suggest enrichment, along with high levels of filamentous algae. Further investigation required.

Species list

Table 115 List of all plant species recorded at Lough Doo

Marginal & Emergent species	**Abundance (DAFOR)**
Arctostaphylos uva-ursi	O
Calluna vulgaris	F
Caltha palustris	R
Carex rostrata	R
Carex virgata	R
Cladium mariscus	R
Equisetum palustre	R
Erica tetralix	F
Hypericum pulchrum	R
Juncus acutiflorus	R
Juncus bulbosus	R
Juncus conglomeratus	R
Juncus effusus	R
Lythrum salicaria	R
Mosses unid	F
Phragmites australis	O
Pinguicula vulgaris	R
Polygala serpyllifolia	R
Potentilla erecta	F
Salix sp.	R
Sphagnum sp.	F
Succisa pratensis	R
Vaccinium myrtillus	O
Submerged & floating species	**% Frequency (n = 41)**
Chara virgata	22
Isoetes lacustris	11
Juncus bulbosus	9
Lobelia dortmanna	6
Myriophyllum alterniflorum	5
Potamogeton obtusifolius	1
Sparganium angustifolium	1
Cladium mariscus	+

Survey data

Site Condition Assessment: Doo Lough (06/08/2014)

Lake Details		**Survey Details**		
Lake Name	Doo Lough	Survey Date	06/08/2014	
SSSI Name		Surveyors	SG, EF	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H039505	Wader Surveys	2	2
WBID / NI No.	50328 / 697	Boat Surveys	2	sections
Site		Survey		

Section Summaries

Section 1

Maximum depth of colonisation (cm)	250 cm
Compass bearing of boat transect (°)	135 °
Lateral distance from waters edge to 75cm depth (m)	1 m

Notes: P1@25cm - 1m from shore, Juncus on raised island

Section 2

Maximum depth of colonisation (cm)	190 cm
Compass bearing of boat transect (°)	315 °
Lateral distance from waters edge to 75cm depth (m)	1 m

Notes:

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end
Section 1	H0386050451	H0395250504	H0391250460	H0390450498
Section 2	H0379950601	H0374050521	H0376750560	H0374850553

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	133-0407	133-0412	133-0413
Section 2	133-0420	133-0418	133-0419

3.22. Tullywannia Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	06 August 2014
NI Lake Number:	699
WBID:	50473
County:	Fermanagh
Grid reference:	H043509
OS Grid reference (X,Y):	204315,350853
Shoreline development index:	1.173
Surface area (ha.):	2
Maximum recorded depth (m):	5.4

Table 116 Condition Assessment Summary Table for Tullywannia Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Mesotrophic: ≥ 8 characteristic species listed	**X**	2 characteristic species present: *S. angustifolium* & *Utricularia vulgaris*
	No loss of characteristic species	**X**	Loss of 3 characteristic species (*L. dortmanna, N. flexilis* & *P. alpinus*) since the NILS survey.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	8% of vegetated sample spots comply for mesotrophic species.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	✓	None recorded. *Lagarosiphon major* recorded in the NILS survey
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	0% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓	At the time of survey the water level was raised with many terrestrial plants present at 0.25 m and 0.5 m survey plots. Around most of the lough emergent vegetation consists of a sparse mixed species reed fringe containing C*. rostrata, C. mariscus, E. fluviatile* and *P. australis*. Beyond the reed fringe various submerged taxa were present including; *F. antipyretica*, *J. bulbosus*, *M. alterniflorum*, *U. vulgaris* & *C. virgata*, as well as floating leaved taxa; *P. natans, N. alba* & *S. angustifolium*. A distinct zone of *N. alba* occurred between 0.75 m – 2.3 m with the emergents *E. fluviatile, P. australis, C. rostrata Eleocharis sp.* & *C. paniculata* also present in this zone.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 5.4 m, Z_s = 0.85 m, Z_v = 2.3 m.
	At least the present structure should be maintained	**✓?**	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Mesotrophic = 15 μgl^{-1}	✓	TP = 14.6 μgl^{-1} (range 9-24) & TN = 0.46 mgl^{-1} (Apr '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.7 (range = 6.4 – 7.0).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X**	Waters mixed throughout water column. Mean DO = 4.22 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	✓	A mixture of peat and silt.
Sediment load	Natural sediment load maintained	✓	The lough sits within a catchment consisting of forestry and rough pasture. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	
	Minimal negative impacts and no fish farming	✓	

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 2 ha, with no loss of extent of open water.

Macrophyte community composition

Tullywannia Lough has a moderately diverse assemblage of macrophyte taxa and is classified under the H3130: Oligotrophic to mesotrophic standing waters. Despite this only 2 characteristic mesotrophic species were recorded; *Sparganium angustifolium* and *Utricularia vulgaris*. As well as these two characteristic species this survey recorded 8 other aquatic taxa: *Chara virgata, Fontinalis antipyretica, Juncus bulbosus, Mosses aquatic, Myriophyllum alterniflorum, Nymphaea alba* and *Potamogeton natans*. Emergent species present included; *Carex rostrata, Cladium mariscus, Equisetum fluviatile, Juncus acutiflorus, Juncus effuses*, *Phragmites australis & Schoenoplectus lacustris.* A comprehensive taxa list is given in Table 120.

There are some differences between the aquatic taxa recorded in this survey compared with the NILS survey in the 1980's. Several taxa are notably absent from the current survey such as *Lobelia dortmanna, Potamogeton alpinus* and the invasive species *Lagarosiphon major*. The absence of *L. major* is surprising given that once found in a waterbody it can dominate and overwhelm native flora. The absence of *L. dortmanna* may indicate trophic change, although the raised and turbid water made it difficult to survey the areas potentially inhabited by *L. dortmanna*. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated from the NILS 1990 data (Table 117).

Negative indicator species

Lagarosiphon major was recorded in the NILS survey in the 1980's however this species was not recorded in the current survey.

Macrophyte community structure

Tullywannia Lough sits within a catchment which is dominated by coniferous forest plantations on raised peat bog as well as rough pasture. At the time of the survey there was evidence of recent tree felling close to the Lough.

At the time of survey the water level was raised with many terrestrial plants present at 0.25 m and 0.5 m survey plots. Around most of the lough emergent vegetation consists of a sparse mixed species reed fringe containing *C. rostrata, C. mariscus*,

E. fluviatile and *P. australis*. Beyond the reed fringe various submerged taxa were present including; *F. antipyretica, J. bulbosus, M. alterniflorum, U. vulgaris* & *C. virgata*, as well as floating leaved taxa; *P. natans, N. alba* & *S. angustifolium*. A distinct zone of N. alba occurred between 0.75 m – 2.3 m with the emergents *E. fluviatile, P. australis, C. rostrata, Eleocharis* sp. & *C. paniculata* also present in this zone.

Table 117 Aquatic macrophyte community composition for Tullywannia Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=24)***
Callitriche spp.	-	-	1	-	-	-
Chara spp.	8.5	7.69	1	-	-	-
Chara virgata	-	-	-	8.5	7.69	8.3
Fontinalis antipyretica	6.3	5.38	1	6.3	5.38	8.3
Juncus bulbosus	3.7	3.08	5	3.7	3.08	20.8
Lagarosiphon major	-	-	+	-	-	-
Liverworts (aquatic)	-	-	1	-	-	-
Lobelia dortmanna	**5.0**	**3.08**	**2**	**-**	**-**	**-**
Mosses aquatic	-	-	1	-	-	12.5
Myriophyllum alterniflorum	5.5	4.23	3	5.5	4.23	4.2
Nitella flexilis* var. *flexilis	**5.5**	**5.38**	**+**	**-**	**-**	**-**
Nuphar lutea	8.5	6.92	2	-	-	-
Nymphaea alba	6.7	3.08	3	6.7	3.08	87.5
Potamogeton alpinus	**5.5**	**5.38**	**2**	**-**	**-**	**-**
Potamogeton berchtoldii	7.3	7.69	1	-	-	-
Potamogeton natans	6.7	4.23	2	6.7	4.23	20.8
Sparganium angustifolium	**3.0**	**4.23**	**2**	**3.0**	**4.23**	**4.2**
Sphagnum (aquatic)	3.7	1.54	1	-	-	-
Utricularia minor	**4.0**	**3.08**	**3**	**-**	**-**	**-**
Utricularia vulgaris	**-**	**-**	**-**	**5.5**	**4.23**	**4.2**
Average score	**5.7**	**4.64**		**5.7**	**4.52**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Water quality

Tullywannia Lough is a shallow (Z_{max} recorded = 5.4 m) mesotrophic lake with an annual mean TP (14.6 μgl^{-1}) which is within the guideline levels for a mesotrophic (15 μgl^{-1}) lake (JNCC 2015) and classifies it as "favourable" with respect to trophic status. Filamentous algal cover was low, as was Chlorophyll *a* levels. The water column was reasonably well mixed although the mean DO was 4.22 mgl^{-1}, below the recommended CSM guidance level for a lake of this type (JNCC, 2015) (Figure 27).

Table 118 Water chemistry data for Tullywannia Lough

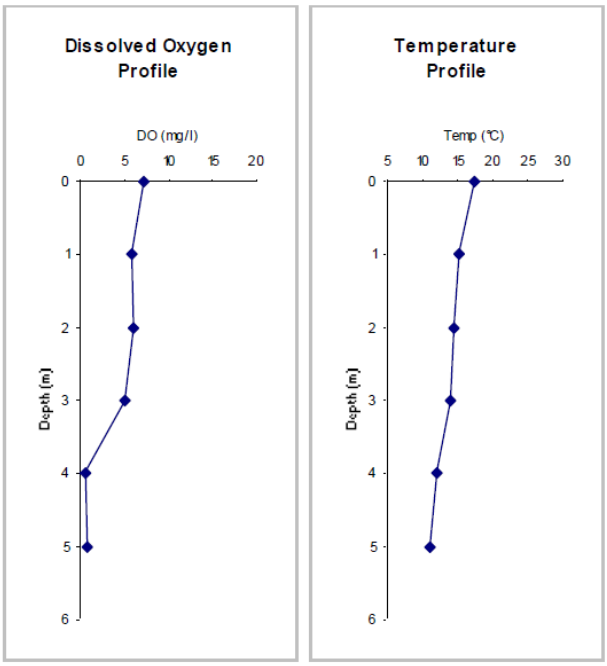
	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1990
TP	24.1	10.1	15.1	9.2	**14.6**	20
SRP	<1.0	<1.0	2.1	3.3	**<1.9**	7
TN	0.42	0.41	0.63	0.39	**0.46**	0.35
TON	<0.005	0.01	0.033	0.053	**<0.025**	-
Nitrite	0.002	<0.001	<0.001	<0.001	**<0.001**	-
Chl *a*	3.80	1.10	11.44	4.60	**5.24**	3.41
DOC	7.90	4.33	15.80	7.72	**8.94**	-
pH	7.00	6.85	6.41	6.75	**6.69**	6.54
Alk	11	8	10	7	**9**	4.6
Cond	76	62	56	88	**71**	101
Ca^{2+}	3.84	2.95	2.85	3.15	**3.20**	3.90
Mg^{2+}	2.26	1.52	1.45	2.09	**1.83**	2.06
Na^{+}	7.77	7.54	6.75	9.94	**8.00**	10.30
K^{+}	0.35	0.37	0.72	0.84	**0.57**	0.34
Cl^{-}	14.70	14.10	12.30	20.60	**15.43**	19.36
SO_4^{2-}	<10	2.76	3.11	3.96	**<4.96**	4.88

Figure 27 Dissolved oxygen and temperature profile for Tullywannia Lough (06/08/2014)

Dissolved Oxygen Profile

GPS Location	H0430850836
Maximum Depth (m)	5.4 m
Secchi Depth (cm)	85 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	7.23	17.3
1	5.84	15.2
2	6.06	14.5
3	4.96	14
4	0.5	12
5	0.7	11



Hydrology

The hydrological regime at the site appears natural.

Lake substrate
The lake basin is predominantly silt and sand.

Sediment load
Tullywannia Lough is surrounded by forestry and blanket peat bog. Forest operations, such as clearfell, within a catchment can add to the sediment load of a lake. There was evidence of recent forest operations within the catchment which can add to the sediment load. Limited evidence of this was apparent at the time of the survey however.

Indicators of local distinctiveness
None present.

Summary
Tullywannia Lough is a poor example of a mesotrophic lake, with a limited characteristic flora. The current survey recorded only 2 characteristic species which were present in 8% of all sample plots. There is some change in the macrophyte flora compared to the NILS 1990 survey with *L. dortmanna* and *P. alpinus* not present in the current survey, however raised water levels and turbid water made sampling some areas difficult. The dominant land cover is coniferous forest plantations which may have had an impact on the aquatic flora. TP levels were just below CSM guideline levels (JNCC 2015) and both filamentous algal cover and chlorophyll a levels were low. Despite the lough showing a few characteristic features of a mesotrophic lake, the number of characteristic species is lower than the target level set in the CSM guidance (JNCC 2015). Given the low number of characteristic species, Tullywannia Lough is classed as being in an **Unfavourable** condition.

Table 119 Tullywannia Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Tullywannia Lough NI Lake 699	**Unfavourable**	Less that the target number of characteristic species for a mesotrophic lake	*Lagarosiphon major* recorded historically at the site but not in the current survey

Species list

Table 120 List of all plant species recorded at Tullywannia Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Angelica sylvestris	R
Calluna vulgaris	R
Cladium mariscus	O
Galium palustre	R
Juncus effusus	R
Myrica gale	R
Phragmites australis	A
Sphagnum sp.	R
Succisa pratensis	R
Submerged & floating species	**% Frequency (n = 24)**
Chara virgata	8
Fontinalis antipyretica	8
Juncus bulbosus	21
Moses aquatic	13
Myriophyllum alterniflorum	4
Nymphaea alba	88
Potamogeton natans	21
Sparganium angustifolium	4
Utricularia vulgaris	4

Survey data

Site Condition Assessment: Tullywannia Lough (06/08/2014)

Lake Details		Survey Details		
Lake Name	Tullywannia Lough	Survey Date	06/08/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	1	out of
Grid Ref (centre)	H043509	Wader Surveys	1	1
WBID / NI No.	50473 / 699	Boat Surveys	1	sections

Site

water

terrestrial

Survey

Raised water level after recent rains. Due to raised

level hard to sample 25 and 50cm as submerged

plants such as calluna etc.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	230 cm
	Compass bearing of boat transect (°)	238 °
	Lateral distance from waters edge to 75cm depth (m)	3 m
	Notes:	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end
Section 1	H0426050775	H0423750865	H0422450813	H0426450837

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0185	0186	0187

3.23. Lough Formal ASSI (MA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	29 August 2014
NI Lake Number:	701
WBID:	50157
County:	Fermanagh
Grid reference:	H047474
OS Grid reference (X,Y):	204744,347381
Shoreline development index:	1.097
Surface area (ha.):	8.8
Maximum recorded depth (m):	10.6

Table 121 Condition Assessment Summary Table for Lough Formal.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed	✓	3 present: *Littorella uniflora, Lobelia dortmanna, Sparganium angustifolium*.
	Mesotrophic: ≥ 8 characteristic species listed	**X**	1 broadleaf *Potamogeton* spp. (*P. alpinus*) and 4 other spp.: *L. uniflora, L. dortmanna, Nitella translucens* and *Sparganium angustifolium*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	*Isoetes lacustris* and *Potamogeton perfoliatus* recorded in 1989 but not 2014. *S. angustifolium* is a recent additional species not recorded before.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	36% of vegetated sample spots comply for mesotrophic species. (42% wader survey (3 transects) & 23% boat (3 transects).
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	2% of sampling points have cover values of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	**X?**	Moorland, heathland, scrub and shrubs surround the majority of the lough, with coniferous woodland the dominating habitat on the S and E. Fringing emergent vegetation is sporadic; S1 & S2 dominated by *Carex rostrata.* Zonation of *Littorelletea* flora is patchy: *L. uniflora* in typical depths (0.25-0.5 m, *L. dortmanna* only in S1 at 0.5 m. No *Isoetes* spp. recorded. Beds of C*hara virgata* found in S1 & S2 up to 1.6 m, with *Fontinalis antipyretica* to similar depths. No plants beyond 1.6 m depth. *S. angustifolium* abundant on the S, with *Potamogeton natans* to the SE of the lough (outside survey transects).
	Maximum depth distribution should be maintained	**-**	Z_{max} = 10.6 m, Z_s = 0.8 m, Z_v = 1.6 m.
	At least the present structure should be maintained	**?**	Previous data insufficient for comparison, although 1989 survey recorded *Isoetes lacustris.*
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	✓	TP = 15 μgl^{-1} (range 10-21) & TN = 0.52 mgl^{-1} (April '14 – Feb. '15). Favourable for mesotrophic.
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.0 (range = 6.7-7.3).

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	X	Waters well oxygenated through photic zone (DO >8 mgl^{-1} from 0–6 m) but mean value below thermocline = 0.35 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	None noted.
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	Marginal substrates rocky with pockets of peat & sand. Silts in the open water
Sediment load	Natural sediment load maintained	✓	No grazing observed. Forested areas to the E and S. Sediment load appears to be natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓	None observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 8.8 ha with no loss of extent to the open water.

Macrophyte community composition

Lough Formal is situated within a catchment of limestone bedrock, with small areas of shallow peat. The water, although clear on S1 and S2, only allowed light penetration down to a depth of 0.8 m. Aquatic vegetation extended to a depth of 1.6 m. In total, 37 macrophyte species were found in the lough in 2014, 10 of which were submerged and floating-leaved aquatics. The *Littorelletea* flora, which is often found in distinct zones of oligotrophic loughs, was patchy in Lough Formal. *Littorella uniflora* was found frequently in the shallower waters, while *Lobelia dortmanna* was recorded only once, on the western side of the lough. *Isoetes lacustris* was absent from the survey. One other oligotrophic species which was observed is *Sparganium angustifolium*, which was present mostly to the south of the lough. Characteristic mesotrophic species that were recorded include *P. alpinus* and *N. translucens.* Only 36% of vegetated sample plots complied for mesotrophic species. Other submerged and floating-leaved species recorded from the lough at varying abundance were: *Callitriche hamulata, Chara virgate, Fontinalis antipyretica, Potamogeton polygonifolius* and *Potamogeton natans.* The marginal emergent vegetation is dominated by *Carex rostrata,* with the occasional *Schoenoplectus lacustris* to the west of the lough. *Juncus articulatus* was also recorded as an intermittent emergent species.

Table 122 Aquatic macrophyte community composition for Lough Formal, including trophic scores.

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=83)***
Callitriche hamulata	-	-	-	5.0	6.15	4
Chara virgata	-	-	-	8.5	7.69	51
Chara spp.	8.5	7.69	1	-	-	-
Fontinalis antipyretica	6.3	5.38	4	6.3	5.38	29
Isoetes lacustris	**5**	**4.23**	**4**	**-**	**-**	**-**
Littorella uniflora	**6.7**	**4.23**	**4**	**6.7**	**4.23**	**14**
Lobelia dortmanna	**5.0**	**3.08**	**3**	**5**	**3.08**	**1**
Nitella translucens	**-**	**-**	**-**	**5.5**	**5.38**	**1**
Potamogeton alpinus	**5.5**	**5.38**	**1**	**5.5**	**5.38**	**5**
Potamogeton natans	6.7	4.23	1	-	-	-
Potamogeton perfoliatus	**7.3**	**7.69**	**1**	**-**	**-**	**-**
Potamogeton polygonifolius	-	-	-	3.0	3.08	4
Sparganium angustifolium	**-**	**-**	**-**	**3.0**	**4.23**	**10**
Potamogeton natans	-	-	-	6.7	4.23	+
Average score	**6.4**	**5.24**		**5.5**	**4.88**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes a species recorded from outside the survey sections or present in the strandline

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 5.55 and 4.88 respectively (Table 122). Both scores from the 1989 survey data were slightly higher, probably because a couple of species recorded in 2014 were relatively low scoring submerged aquatic plants compared to those in 1989. Species lists from both 1989 and 2014 are marginally different, with *Isoetes lacustris* and *Potamogeton perfoliatus* recorded in 1989 but not in 2014, while *Sparganium angustifolium, Potamogeton polygonifolius* and *Callitriche hamulata* are additional species to the lough.

Negative indicator species

No alien or nuisance species were recorded from the site. Moderate levels of filamentous algae were recorded however: coverage of 21.1% on the wader transects and 10.2% on the boat transects was noted but only 2% of sampling points have cover values of '3'.

Macrophyte community structure

Wet heath and acid grassland surround the majority of the lough. Coniferous forest plantation lies to the south and east. *Alnus glutinosa* and *Salix* sp. trees are scattered along the lough margins, with *Juncus articulatus, Juncus effusus* and *Calluna vulgaris* are commonly found within close vicinity to the lough shore. The

fringing emergent vegetation is patchy, mainly consisting of *Carex rostrata,* which dominates the shallow waters to the west and south of the lough at depths of ~75 cm. Zonation of *Littorelletea* flora is atypical for a lough of this type, with frequent coverage of *L. uniflora* to depths of 0.5 m, but rare instances of *L. dortmanna* (recorded once in S1 at 0.5 m) and no *Isoetes lacustris* recorded. By comparison, *Isoetes lacustris* was recorded with an abundance of '4' (1-5 scale) in 1989. *S. angustifolium* was frequently recorded in S2, which is to the south of the lough, at depths of ≥75 cm. To the east of this section, a large expanse of *Potamogeton natans* was observed, which was outside the constraints of the survey sections. Extensive beds of *Chara virgata* were recorded in S1 and S2, with an abundance of '4' (on a 1-5 scale), growing in depths between 50 – 160 cm. *Fontinalis antipyretica* was also recorded frequently at these depths. The current structure is not considered to be favourable for a site of this type.

Water quality

Table 123 Water chemistry data for Lough Formal

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1989
TP	10.3	15.7	21.1	10.9	**14.5**	30
SRP	1.6	1.0	3.7	2.9	**2.3**	3
TN	0.4	0.6	0.6	0.4	**0.5**	0.49
TON	0.029	0.007	0.036	0.042	**0.028**	-
Nitrite	0.003	0.001	0.001	0.001	**0.001**	-
Chl *a*	2.5	1.9	3.1	1	**2.1**	10.94
DOC	9.3	14.4	14.6	10.4	**12.2**	-
pH	7.3	7.1	6.7	6.7	**6.9**	7.55
Alk	11	26	16	9	**15.5**	6.4
Cond	69	81	64	83	**74.3**	83
Ca^{2+}	4.2	7.5	5	4.5	**5.3**	4.64
Mg^{2+}	1.3	1.5	1.4	1.6	**1.5**	1.6
Na^{+}	7.1	6.8	7	9.6	**7.6**	5.32
K^{+}	0.3	0.2	0.3	0.4	**0.3**	0
Cl^{-}	14.3	12.5	13.3	20.1	**15.1**	14.3
SO_4^{2-}	<10	2.7	3.2	4	**4.9**	5.1

The water chemistry of Lough Formal is fairly typical for a mesotrophic lough, having a circumneutral pH (mean = 6.9) and low to moderate ionic concentrations. The water colour is peaty brown and although it was clear at the time of survey, light penetration only reached a depth of 0.8 m. Total phosphorus concentrations are seasonably variable and the mean annual concentration is just below the target level set in the CSM guidelines for deeper mesotrophic lake types (15 $\mu g l^{-1}$, JNCC 2015), however it is recognised that the interaction of nutrients in peaty sites is complex and therefore elevated TP is not always indicative of unfavourable conditions. Total nitrogen was low and the lough shows limited direct evidence of the effects of nutrient enrichment: Chl *a* concentrations were low throughout the year, although

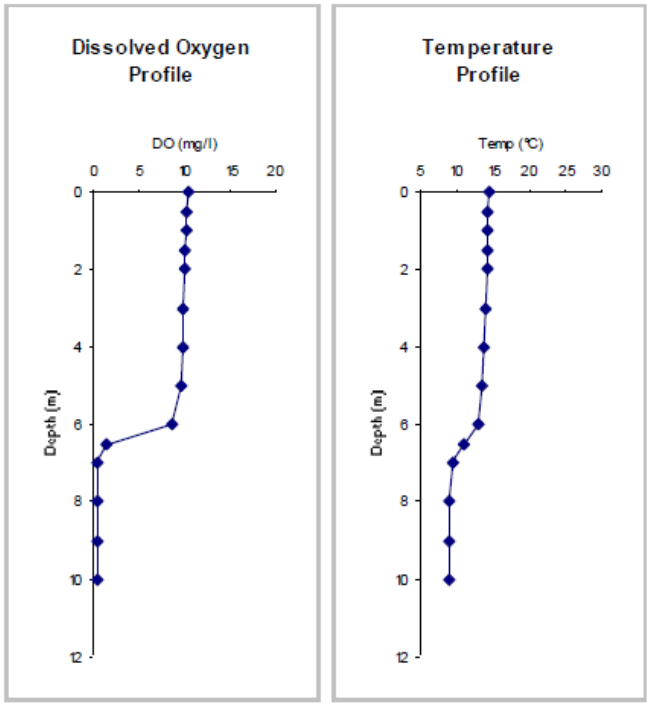
filamentous algae cover was observed to be at low to moderate levels. The lough was well oxygenated throughout the photic zone at the time of survey in August 2014 (>8 mgl^{-1} from 0–6 m) but the mean value below thermocline was 0.35 mgl^{-1} which does not meet the target level of > 7.0 mgl^{-1} as set by the CSM guidelines (JNCC 2015) (Figure 28).

Figure 28 Dissolved oxygen and temperature profile for Lough Formal (29/08/2014)

Dissolved Oxygen Profile

GPS Location	H0479647349
Maximum Depth (m)	10.6 m
Secchi Depth (cm)	80 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	10.31	14.4
0.5	10.17	14.3
1	10.14	14.3
1.5	10.08	14.3
2	10	14.3
3	9.81	13.9
4	9.8	13.7
5	9.58	13.5
6	8.68	13.1
6.5	1.42	11
7	0.32	9.4
8	0.34	9.1
9	0.36	9.1
10	0.38	9.1



Hydrology

Lough Formal is a small lough with an outflow stream to the north of the water body, which joins the Roogagh River. The Roogagh River flows west/northwest until it drains into Lough Melvin. The lough itself is situated on a faulted outlier called the Carboniferous Knockmore Limestone Member, which has a significant influence over the local flora, since calcium-rich waters flush through the soils (DOENI, 2012) . The hydrological regime at the site appears natural.

Lake substrate

Lough Formal is a predominantly limestone-rich catchment, with peat substrate towards the margins of the lake. Marginal substrates are rocky with pockets of sand. The open water substrates are silty.

Sediment load

The lough is surrounded by heathland, shrubs and scrub, with coniferous forest to the east and south. No grazing was observed at the time of survey and there was no direct evidence of increased sediment load to the site.

Indicators of local distinctiveness

None specified.

Summary
Lough Formal is classified as an "oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*". The lough meets the floristic compositional targets defined within the CSM guidance (JNCC 2015) for an oligotrophic lake, supporting three *Littorelletea* species (*L. uniflora, L. dortmanna* and *S. angustifolium)* but fails to meet the floristic targets for a mesotrophic lake, with only one broadleaf *Potamogeton* sp. (*P. alpinus)* and four other characteristic species (*Littorelletea* spp. as listed above, plus *N. translucens*). The characteristic zoning of *Littorelletea* spp. was not observed and therefore considered unfavourable. In addition, only 36% of vegetated sample spots complied for mesotrophic species. However, the water chemistry of the lough appears to be in favourable condition for a mesotrophic lake, with mean annual TP concentration just below the feature type target and lower than the spot sample taken in 1989. No firm conclusions can be drawn from these two sets of independent data as seasonal variation was not taken into account in the 1989 survey. Although filamentous algae cover was low to moderate, there was no direct evidence to suggest nutrient enrichment. The current status the Lough Formal is considered to be **favourable (at risk),** based upon floristic composition and water quality targets. The lake is showing signs of moving away from an oligotrophic state and towards becoming mesotrophic, although the variety and coverage of species is poor in respect to this.

Table 124 Lough Formal: Overview

Water Body	Status	Reason(s) for Risk	Comments
Lough Formal NI Lake 701	**Favourable (at risk)**	Impact of forestry unknown, but of potential concern during felling and planting.	Low frequency of characteristic species for both oligotrophic and mesotrophic status. Floristic compositional targets not met for mesotrophic and *Littorelletea* zones not clear. Water chemistry below feature targets for mesotrophic and appeared to have improved since 1989.

Species list

Table 125 List of all plant species recorded at Lough Formal: 2014

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Alnus glutinosa	R
Angelica sylvestris	R
Blechnum spicant	R
Calluna vulgaris	R
Caltha palustris	R
Carex nigra	R
Carex rostrata	O
Equisetum fluviatile	R
Equisetum palustre	R
Filipendula ulmaria	R
Galium palustre	R
Juncus articulatus	F
Juncus effusus	R
Mentha aquatica	R
Mentha sp.	O
Menyanthes trifoliata	R
Mosses unid	F
Potentilla erecta	F
Ranunculus flammula	R
Salix sp.	O
Senecio aquaticus	R
Sphagnum sp.	O
Succisa pratensis	R
Vaccinium myrtillus	O
Submerged & floating species	**% Frequency (n = 83)**
Callitriche hamulata	4
Chara virgata	51
Fontinalis antipyretica	29
Littorella uniflora	14
Lobelia dortmanna	1
Nitella translucens	1
Potamogeton alpinus	5
Potamogeton polygonifolius	4
Sparganium angustifolium	10
Potamogeton natans	+

Survey data

Site Condition Assessment: Formal Lough (29/08/2014)

Lake Details		**Survey Details**		
Lake Name	Formal Lough	Survey Date	29/08/2014	
SSSI Name		Surveyors	SG, ST	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H047474	Wader Surveys	3	3
WBID / NI No.	50157 / 701	Boat Surveys	3	sections

Site Survey

Section Summaries

Section 1

Maximum depth of colonisation (cm)	120 cm
Compass bearing of boat transect (°)	278 °
Lateral distance from waters edge to 75cm depth (m)	5 m

Notes:

Section 2

Maximum depth of colonisation (cm)	140 cm
Compass bearing of boat transect (°)	180 °
Lateral distance from waters edge to 75cm depth (m)	3 m

Notes: Fresh water sponges present in chara beds.

Section 3

Maximum depth of colonisation (cm)	140 cm
Compass bearing of boat transect (°)	338 °
Lateral distance from waters edge to 75cm depth (m)	7 m

Notes: Fresh water sponges @ P1, 50cm, 75cm and >75cm

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end
Section 1	H0455757293	H0456147398	H0455647348	H0457247342
Section 2	H0473247243	H0483447252	H0478347246	H0478747863
Section 3	H0478647508	H0490447502	H0482747506	H0482147477

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	137-0445	137-0447	137-0446
Section 2	137-0448	137-0453	137-0452
Section 3	0454	0456	0455

3.24. Martincrossagh Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	29 August 2014
NI Lake Number:	709
WBID:	50697
County:	Fermanagh
Grid reference:	H058428
OS Grid reference (X,Y):	205791,342791
Shoreline development index:	1.134
Surface area (ha.):	1
Maximum recorded depth (m):	0.8 m

Table 126 Condition Assessment Summary Table for Martincrossagh Lough.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Mesotrophic: ≥ 8 characteristic species	**X**	2 characteristic species present: *S. angustifolium & N. flexilis agg.*
	No loss of characteristic species	**X**	Loss of 2 characteristic species (*L. uniflora & P. alpinus*) since the NILS survey.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	35% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	None recorded.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	0% of sampling points scored a cover value of '3'

Attribute	Target	Status	Comment
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Lough Martincrossagh is extremely shallow (<1m depth) therefore it is unlikely to show typical mesotrophic vegetation zones. Emergent vegetation consists of a sparse mixed species fringe of C*. rostrata, E. palustris, E. fluviatile, S. erectum* and *T. latifolia*. *P. polygonifolius* was also present amongst the emergent species at 0.25m depth. A small patch of *S. angustifolium* was recorded in the wader survey at 0.75m depth. The only submerged macrophyte taxa recorded were *N. flexilis agg*. and *C. virgata*, the former growing at depths >0.75cm and the later present at all depths and in places abundant.
	Maximum depth distribution should be maintained	✓	Z_{max} = 0.8 m, Z_s = 0.8 m, Z_v = 0.8 m.
	At least the present structure should be maintained	✓**?**	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Mesotrophic = 20 µgl^{-1}	**X**	TP = 23 µgl^{-1} (range 15-39) & TN = 0.75 mgl^{-1} (Apr '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.46 (range = 6.2 – 6.8).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	✓	Waters well oxygenated: Mean DO = 10.43 mgl^{-1} throughout water column. Very shallow
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of silt and sand
Sediment load	Natural sediment load maintained	✓	The lough sits within a catchment consisting of forestry and rough pasture. Sediment load appears natural.
	Distinctive elements maintained	✓	

Attribute	Target	Status	Comment
Indicators of local distinctiveness	Minimal negative impacts and no fish farming	✓	

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1 ha, with no loss of extent of open water.

Macrophyte community composition

Martincrossagh Lough is a very shallow (0.8 m depth) brown water mesotrophic lough surrounded by forestry plantation. The lough has a poor diversity of macrophyte taxa and is classified under the H3130: Oligotrophic to mesotrophic standing waters. Only 2 characteristic mesotrophic species were recorded; *Sparganium angustifolium* and *Nitella flexilis agg*. As well as these two characteristic species this survey recorded 2 additional aquatic taxa: *Chara virgata & Potamogeton polygonifolius*. Emergent species present included; *Carex rostrata, Equisetum fluviatile, Eleocharis palustris, Hydrocotyle vulgaris, Potentilla palustris, Sparganium erectum and Typha latifolia.* A comprehensive taxa list is given in Table 130.

There are major differences between the aquatic taxa recorded in this survey compared with the NILS survey in the 1980's. The NILS survey recorded 6 taxa: *Lemna minor, Littorella uniflora, Nuphar lutea, Potamogeton alpinus, Sparganium angustifolium* and *Fontinalis antipyretica*. *Sparganium angustifolium* was the only taxa recorded in both the NILS survey and the current survey. Clearly a shift in trophic status has occurred since the NILS survey even when the methodological differences in both surveys are taken into account. The site is very shallow with a heavy silt load around the margins. It's possible that land management such as forestry operations within the catchment has caused an increase in sedimentation and thus a change in the lakes ecology. Without this historical data however it is hard to make this conclusion from this macrophyte survey alone. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are lower than those calculated from the NILS 1989 data, also suggesting at a trophic shift (Table 217).

Negative indicator species

None recorded

Macrophyte community structure

Martincrossagh Lough sits within a catchment which is dominated by coniferous forest plantations on raised peat bog as well as rough pasture. At the time of the survey there was evidence of recent tree felling close to the Lough. Aerial photography also shows that clearfell and new planting has occurred within the catchment within the past decade.

Lough Martincrossagh is extremely shallow (<1m depth) therefore it is unlikely to show typical mesotrophic vegetation zones. Around most of the lough emergent vegetation consists of a sparse mixed species reed fringe containing *C. rostrata, E. palustris, E. fluviatile, S. erectum* and *T. latifolia. P. polygonifolius* was also present

amongst the emergent species at 0.25m depth. A small patch of *S. angustifolium* was recorded in the wader survey at 0.75m depth. The only submerged macrophyte taxa recorded were *N. flexilis* agg. and *C. virgata*, the former growing at depths >0.75cm and the later present at all depths and in places abundant.

Table 127 Aquatic macrophyte community composition for Martincrossagh Lough, including trophic scores

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=31)***
Chara virgata	-	-	-	8.5	7.69	38.7
Fontinalis antipyretica	6.3	5.38	5	-	-	-
Lemna minor	9.0	8.85	1	-	-	-
Littorella uniflora	**6.7**	**4.23**	**2**	**-**	**-**	**-**
Nuphar lutea	8.5	6.92	1	-	-	-
Potamogeton alpinus	**5.5**	**5.38**	**2**	**-**	**-**	**-**
Nitella flexilis agg.	**-**	**-**	**-**	**5.5**	**5.38**	**32.3**
Potamogeton polygonifolius	-	-	-	3.0	3.08	9.7
Sparganium angustifolium	**3.0**	**4.23**	**2**	**3.0**	**4.23**	**3.2**
Average score	**6.5**	**5.83**		**5.0**	**5.10**	

Water quality

Martincrossagh Lough is a very shallow (Z_{max} recorded = 0.8 m) mesotrophic lake with an annual mean TP (23 μgl^{-1}) which is above the guideline levels for a mesotrophic lough (20 μgl^{-1}, JNCC 2015) and classifies it as “unfavourable” with respect to trophic status (Table 128). Filamentous algal cover was also higher than 10%. Chlorophyll a amounts were low. The water column was well oxygenated within the limited depth (Figure 29).

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silt and sand.

Sediment load

Martincrossagh Lough is surrounded by forestry and blanket peat bog. Forest operations, such as clearfell, within a catchment can add to the sediment load of a lake. There was evidence of recent forest operations within the catchment which can add to the sediment load. In places an excessive amount of silt was present, especially in the lake margins.

Indicators of local distinctiveness

None present.

Table 128 Water chemistry data for Martincrossagh Lough

	Apr. ’14	Aug '14	Nov '14	Feb ’15	Mean	1989
TP	18.7	14.5	18.9	39.3	**23**	47
SRP	2.8	<1.0	2.7	2.1	**<2.2**	5
TN	0.74	0.66	0.75	0.84	**0.75**	0.84
TON	<0.005	<0.005	0.016	<0.005	**<0.008**	-
Nitrite	0.003	<0.001	<0.001	<0.001	**0.003**	-
Chl *a*	5.94	1.73	2.97	8.25	**4.72**	3.93
DOC	14.9	11	21.8	12.2	**15**	-
pH	3.94	5.45	6.86	4.61	**5.2**	7.33
Alk	13	14	15	6	**12**	6.4
Cond	63	65	69	99	**74**	106
Ca^{2+}	3.94	5.45	6.86	4.61	**5.2**	5.06
Mg^{2+}	0.921	0.997	1.08	1.61	**1.152**	1.64
Na^{+}	7.61	6.49	6.89	12.2	**8.3**	7.8
K^{+}	0.288	0.25	0.436	0.418	**0.35**	0.16
Cl^{-}	15.9	12.5	12.8	25.7	**16.7**	21.9
SO_4^{2-}	<10	1.88	4.28	4.36	**<5.13**	4.8

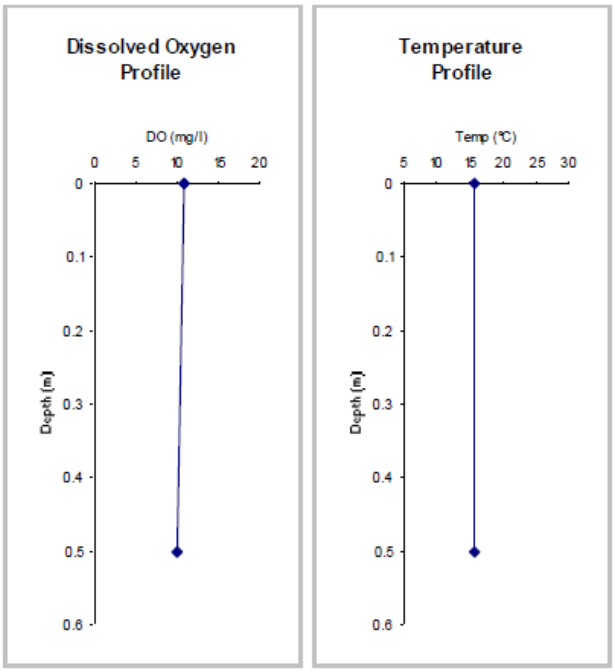
Figure 29 Dissolved oxygen and temperature profile for Martincrossagh Lough (29/08/2014)

Dissolved Oxygen Profile

GPS Location	H0577842809
Maximum Depth (m)	0.8 m
Secchi Depth (cm)	-

Notes: Secchi depth >70cm

Depth (m)	DO (mg/l)	Temp (°C)
0	10.76	15.6
0.5	10.1	15.7



Summary

Martincrossagh Lough is a poor example of a mesotrophic lake, with a limited characteristic flora. However given its small size and very shallow depth the amount of available habitat for a large diversity of mesotrophic species is limited. The current survey recorded only 2 characteristic species which were present in 35% of all sample plots. There is a clear change in the macrophyte flora compared to the NILS 1989 survey with *L. uniflora* and *P. alpinus* not present in the current survey. The only species recorded in both surveys was *S. angustifolium.* The dominant land cover is coniferous forest plantations which may have had an impact on the aquatic flora. TP levels were above CSM guideline levels (JNCC 2015) as was filamentous algal cover but chlorophyll a levels were low. Given the low number of characteristic species and high TP amounts and filamentous algal cover; Martincrossagh Lough is classed as being in an **Unfavourable** condition.

Table 129 Martincrossagh Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Martincrossagh Lough NI Lake 709	**Unfavourable**	Less that the target number of characteristic species for a mesotrophic lake, high TP amounts and filamentous algal cover	Significant change in the macrophyte community since the NILS survey.

Species list

Table 130 List of all plant species recorded at Martincrossagh Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Alnus glutinosa	O
Caltha palustris	R
Carex nigra	F
Carex rostrata	A
Carex sp.	R
Drosera rotundifolia	R
Eleocharis palustris	R
Epilobium palustre	R
Equisetum fluviatile	F
Equisetum palustre	F
Galium palustre	F
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Juncus articulatus	O
Juncus effusus	R
Lemna minor	R
Lychnis flos-cuculi	R
Potentilla palustris	O
Ranunculus flammula	O
Rorippa nasturtium-aquaticum agg.	R
Salix sp.	O
Sparganium erectum	A
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 31)**
Chara virgata	39
Nitella flexilis agg.	32
Potamogeton polygonifolius	10
Sparganium angustifolium	3

Survey data

Site Condition Assessment: Martincrossagh Lough (29/08/2014)

Lake Details		**Survey Details**	
Lake Name	Martincrossagh Lough	Survey Date	29/08/2014
SSSI Name		Surveyors	ES & GC
SAC Name		Shore Surveys	1 out of
Grid Ref (centre)	H058428	Wader Surveys	1 1
WBID / NI No.	50697 / 709	Boat Surveys	1 sections

Site Notes:

Survey Notes:

Section Summaries

Section 1	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	105 °
	Lateral distance from waters edge to 75cm depth (m)	-
	Notes: Baby frog seen. 2641 section panorama	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H0581942832	H0585442745	H0582942795	H0576842802

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	2638	2631	2638

3.25. Namanfin Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	29 August 2014
NI Lake Number:	711
WBID:	50292
County:	Fermanagh
Grid reference:	H054457
OS Grid reference (X,Y):	205380,345717
Shoreline development index:	1.147
Surface area (ha.):	4.1
Maximum recorded depth (m):	8.7

Table 131 Condition Assessment Summary Table for Namanfin Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓	4 characteristic species present: *L. uniflora, L. dortmanna, S. angustifolium* and *I. lacustris*
	No loss of characteristic species	✓	No loss of characteristic species since the NILS survey
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	79% of vegetated sample spots comply for oligotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	None present

Attribute	Target	Status	Comment
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Small amount (<1%) of filamentous algae recorded. No sampling point was scored with a cover value of '3'.
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Around most of the lough emergent vegetation is sparse. Where it occurs it consists of *C. rostrata*, *E. palustris* and *E. fluviatile*. Occasional *P. polygonifoliu*s and *J. bulbosus* in the shallows (0.25cm). *L. uniflora* occasionally emergent but predominantly submerged between 0 - 1 m. *L. dortmanna* present between 0.50 – 1.2 m. *I. lacustris* present up to 1.8m. *M. alterniflorum* present in section 2 between 1.8 - 2 m. A large patch of *S. angustifolium* at 1 m depth in section 3. *N. flexilis agg* present up to 2.3 m depth with a large patch of this species in section 3 where the depth is ~2m for at least 20m from the shore.
	Maximum depth distribution should be maintained	-	Z_{max} = 8.7 m, Z_s = 1.65m, Z_v = 2.3 m.
	At least the present structure should be maintained	✓?	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1}	✓	TP = 8.98 µgl^{-1} (range 8-11) & TN = 0.35 mgl^{-1} (April '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 6.83 (range = 6.6 – 7.1).
	Adequate dissolved throughout the water column (mean > 7 mgl^{-1} below thermocline)	X	DO levels <5 mgl^{-1} below the thermocline but well oxygenated above.
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of silt and sand substrates at the margins, with occasional boulders and cobbles.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓?	The lough sits within a large tract of forestry and blanket bog. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	Diverse characteristic elements present.
	Minimal negative impacts and no fish farming	✓	

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 4.1 ha, with no loss of extent of open water.

Macrophyte community composition

Namanfin Lough has a characteristic assemblage of macrophyte taxa, typical for an oligotrophic lake. This survey recorded 8 aquatic species, 4 of which were characteristic oligotrophic species (JNCC 2015) (*L. uniflora, I. lacustris, L. dortmanna,* and *S. angustifolium*). Four other aquatic species were recorded (*J. bulbosus, N. flexilis* agg*, P. polygonifolius, M. alterniflorum*), which although not classed as characteristic under the CSM guidance (JNCC 2015) they are typical of this lake type. Emergent species present were; *C. rostrata*, *E. palustris, E. fluviatile,* and *J. acutiflorus*. A total of 22 aquatic and wetland taxa were recorded in this survey.

Table 132 Aquatic macrophyte community composition for Namanfin Lough, including trophic scores

	1989 (NILS)			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=101)***
Charophytes	8.5	7.69	2	-	-	-
Isoetes lacustris	**5.0**	**4.23**	**5**	**5.0**	**4.23**	**41.6**
Juncus bulbosus	-	-	-	3.7	3.08	4
Littorella uniflora	**6.7**	**4.23**	**5**	**6.7**	**4.23**	**54.4**
Lobelia dortmanna	**5.0**	**3.08**	**4**	**5.0**	**3.08**	**41.6**
Myriophyllum alterniflorum	-	-	-	5.5	4.23	4
Nitella flexilis agg.	6.7	5.38	+	5.5	5.38	20.8
Potamogeton polygonifolius	-	-	-	3.0	3.08	7.9
Sparganium angustifolium	**3.0**	**4.23**	**2**	**3.0**	**4.23**	**8.9**
Average score	**5.7**	**4.8**		**5.4**	**3.9**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

The NI lake survey (NILS) recorded a very similar set of species at Namanfin Lough as the current survey. The only difference's in terms of characteristic species was the presence of Charophytes in the NILS survey but absence in the current survey and the presence of *M. alterniflorum* in the current survey but absence in the NILS survey. All the characteristic species were present in both surveys, suggesting that the site is stable floristically. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated from the NILS 1989 data.

Negative indicator species

No negative indicator species were recorded.

Macrophyte community structure

Namanfin Lough sits within a catchment dominated by conifer plantations and blanket peat bog. Conifer plantations surround the lough although there is a ~10-20 m buffer between the trees and the lake shore.

Emergent vegetation was sparse. It occurs in patches and consists of *E. fluviatile, E. palustris* and *C. rostrata*. More commonly the emergent zone was dominated by *L. uniflora* which is predominantly in the shallows (0.25-0.75 m) and present up to 1 m. Occasional *J. bulbosus* and *P. polygonifolius* in the shallows (25 cm). *L. dortmanna* present in slightly deeper water (0.5-1.2m) and *I. lacustris* present up to 1.8m. *M. alterniflorum* present in section 2 between 1.8 - 2 m. A large patch *of S. angustifolium* at 1 m depth in section 3. *N. flexilis agg* present up to 2.3 m depth with a large patch of this species in section 3 where the depth is ~2m for at least 20m from the shore. The above structure is consistent with oligotrophic lakes and shows clear zonation.

Water quality

Table 133 Water chemistry data for Namanfin Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1989
TP	8.3	9.01	10.9	7.7	8.98	44
SRP	1.3	<1.0	1.1	1.2	1.2	1
TN	0.34	0.34	0.39	0.31	0.35	1.23
TON	<0.005	<0.005	0.008	0.018	<0.009	n/a
Nitrite	0.001	<0.001	<0.001	<0.001	<0.001	n/a
Chl *a*	1.9	1.00	4.84	1.2	2.65	11
DOC	5.89	6.31	6.59	6.81	6.4	n/a
pH	7.13	6.97	6.64	6.73	6.83	7.43
Alk	<5	6	6	<5	<5.5	4.5
Cond	58	56	56	69	60	72
Ca^{2+}	2.25	2.68	2.85	2.56	2.59	3.28
Mg^{2+}	0.867	0.878	0.886	1.08	0.928	1.2
Na^{+}	7.02	6.8	6.9	8.72	7.36	6.7
K^{+}	0.266	0.245	0.295	0.363	0.292	0.1

Cl^-	13.6	12.6	12.2	16.8	13.8	14.3
SO_4^{2-}	<10	2.98	3.46	3.79	<5.06	6.1

Namanfin Lough is a shallow (Z_{max} recorded = 8.7 m) brown water lake with an annual mean TP (8.98 μgl^{-1}) which is below the guideline levels for an oligotrophic (10 μgl^{-1}) lake (JNCC 2015) and classifies it as "favourable" with respect to trophic status. Filamentous algal cover was low, as was Chlorophyll a amounts. The water column was well oxygenated (> 8 mgl^{-1}) above 6 m depth. (Figure 30)

Hydrology
The hydrological regime at the site appears natural.

Lake substrate
The lake basin is predominantly silt and sand.

Sediment load
Namanfin Lough is surrounded by forestry and blanket peat bog. Forest operations, such as clearfell, within a catchment can add to the sediment load of a lake. Little evidence of recent forest operations within the immediate vicinity of the lough was apparent at the time of the survey. This may explain the natural sediment load and water chemistry. If large tracts of trees are felled within the lakes catchment, the sediment load would be expected to increase.

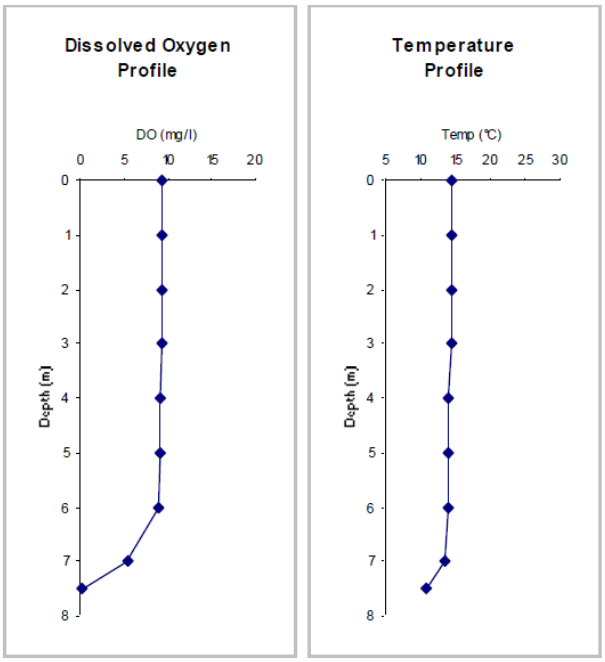
Indicators of local distinctiveness
The lough maintains a good characteristic Isoetid flora.

Figure 30 Dissolved oxygen and temperature profile for Namanfin Lough (29/08/2014)

Dissolved Oxygen Profile

GPS Location	H0540645704
Maximum Depth (m)	8.7 m
Secchi Depth (cm)	165 cm
Notes:	Windy day

Depth (m)	DO (mg/l)	Temp (°C)
0	9.34	14.4
1	9.32	14.4
2	9.3	14.4
3	9.26	14.4
4	9.1	14.1
5	9.04	14.1
6	8.98	14
7	5.5	13.5
7.5	0.2	10.9



Summary

Namanfin Lough is a good example of an oligotrophic lake, with characteristic flora and water chemistry. The current survey recorded 4 characteristic species (3 x Isoetid species and *M. alterniflorum*). These characteristic species were recorded in 79% of all sample plots. There is little change in the macrophyte flora compared to the NILS 1989 survey. The dominant land cover is coniferous plantations and blanket peat bog. The presence of forestry doesn't appear to be having a negative impact on the lough's water chemistry, sediment load or flora, perhaps due to no obvious recent felling within the catchment. TP levels were within CSM guideline levels (JNCC 2015) and both filamentous algal cover and chlorophyll *a* levels were low. Given the characteristic flora and water chemistry, Namanfin Lough is classed as **Favourable, at risk.** The only identified risk is that of potential future forest operations within the catchment.

Table 134 Namanfin Lough: Overview

Water Body	Status	Reason(s) for at risk	Comments
Namanfin Lough NI Lake 711	**Favourable, at risk**	Forest plantations within the catchment, potential risk of felling operations affecting sediment load and water chemistry.	Characteristic macrophyte flora that appears to be stable since the NILS survey.

Species list

Table 135 List of all plant species recorded at Namanfin Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Calluna vulgaris	R
Carex rostrata	O
Eleocharis palustris	R
Epilobium palustre	R
Equisetum fluviatile	R
Juncus acutiflorus	R
Juncus effusus	R
Luzula sylvatica	R
Myosotis laxa	R
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	R
Sphagnum sp.	O
Succisa pratensis	R
Submerged & floating species	**% Frequency (n = 101)**
Isoetes lacustris	42
Juncus bulbosus	4
Littorella uniflora	54
Lobelia dortmanna	42
Myriophyllum alterniflorum	4
Nitella flexilis agg.	21
Potamogeton polygonifolius	8
Sparganium angustifolium	9

Survey data

Site Condition Assessment: Namanfin Lough (29/08/2014)

Lake Details		**Survey Details**		
Lake Name	Namanfin Lough	Survey Date	29/08/2014	
SSSI Name		Surveyors	SD & HG	
SAC Name		Shore Surveys	3	out of
Grid Ref	H054457	Wader Surveys	3	3
WBID / NI No.	50292 / 711	Boat Surveys	3	sections

Site Notes:

Survey Notes:
Emporer Dragonfly, Juvenile Frog, Newt and Peacock butterfly observed

Section Summaries

Section 1	Maximum depth of colonisation (cm)	180 cm
	Compass bearing of boat transect (°)	55 °
	Lateral distance from waters edge to 75cm depth (m)	6 m
	Notes:	
Section 2	Maximum depth of colonisation (cm)	210 cm
	Compass bearing of boat transect (°)	171 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes:	
Section 3	Maximum depth of colonisation (cm)	230 cm
	Compass bearing of boat transect (°)	269 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes:	

Section Locations

		Shore Survey GPS Co-ords start	Shore Survey GPS Co-ords end	Boat Survey GPS Co-ords start (shore)	Boat Survey GPS Co-ords end (lake)
Section	**1**	H0540145833	H0547245788	H0544145827	H0543445793
Section	**2**	H0551345654	H0541945619	H0546845632	H0545845669
Section	**3**	H0521845636	H0528345711	H0524645673	H0534745683

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	122 - 0263	122 - 0262	122 - 0261
Section	**2**	0264	0265	0266/0267
Section	**3**	-	274	273

3.26. Lattone Lough (LA D)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	26 August 2014
NI Lake Number:	776
WBID:	50032
County:	Fermanagh
Grid reference:	H000454
OS Grid reference (X,Y):	200041,345401
Shoreline development index:	1.489
Surface area (ha.):	31.1
Maximum recorded depth (m):	14.5

Table 136 Condition Assessment Summary Table for Lattone Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Mesotrophic: ≥8 other characteristic species	✓	8 characteristic species present; *I. lacustris, L. uniflora, L. dortmanna, N. flexillis, P. alpinus, P. gramineus, P. perfoliatus* & *Sparganium angustifolium*
	No loss of characteristic species	✓?	*Potamogeton x nitens* recorded in NILS survey. *I. lacustris* and *N. flexilis* new to list.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	76% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	*Elodea canadensis* present in 37.6% of submerged plots. Present at least since the NILS survey

Attribute	Target	Status	Comment
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Filamentous algae recorded throughout (mostly 1s). Median cover score = 1.
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Around most of the lough emergent vegetation is sparse. Where it occurs it consists of *C. rostrata*, *E. palustris*, *E. fluviatile*, *P. australis* and *S. lacustris*. *L. uniflora* occasionally emergent but predominantly submerged between 0 - 0.75 m. *L. dortmanna* present between 0.50 - 0.75 m . *I. lacustris* present up to 2.2m in section 4. *M. alterniflorum* also present between 0.25 – 1 m. Occasional patches of lily consisting of *N. lutea* and *N. alba*. Diverse assemblage of *Potamogeton* spp growing at all vegetated depths. *P. filiformis* common in section 2, *P. perfoliatus* in deeper water up to 1.7 m. *C. virgata, C. aspera* and *N. flexillis* at all vegetated depths, not occupying a clear zone. *E. canadensis* scattered throughout the lough, nowhere does it dominate.
	Maximum depth distribution should be maintained	✓	Z_{max} = 14.5 m, Z_s = 1.2 m, Z_v = 2.1 m.
	At least the present structure should be maintained	✓**?**	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Mesotrophic = 15 μgl^{-1}	**X**	TP = 29.5 μgl^{-1} (range 20-39) & TN = 0.65 mgl^{-1} (April '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.72 (range = 7.6 – 7.9).
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	✓	Waters well oxygenated: DO >8.11 mgl^{-1} >10 m. 0.18 mgl^{-1} below the thermocline.
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	✓	A mixture of silt and sand substrates at the margins, with occasional boulders and cobbles.
Sediment load	Natural sediment load maintained	✓?	Most of the land use around the lough is rough pasture. May be some impact due to grazing pressure but stocking rates appear low. Small amount of forestry plantation in the catchment.
Indicators of local distinctiveness	Distinctive elements maintained	✓	Diverse characteristic elements present.
	Minimal negative impacts and no fish farming	✓	

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 31.1 ha, with no loss of extent of open water.

Macrophyte community composition

Lattone Lough has a diverse characteristic assemblage of macrophyte taxa, typical for a mesotrophic lake. This survey recorded 19 aquatic species, 8 of which were characteristic mesotrophic species (JNCC 2015) (*Littorella uniflora, Isoetes lacustris, Lobelia dortmanna, Nitella flexilis, Potamogeton gramineus, Potamogeton perfoliatus, Potamogeton alpinus* and *Sparganium angustifolium*). 4 other *Potamogeton* spp. were recorded (*P. berchtoldii, P. filiformis, P. natans* & *P. pectinatus*). 2 species of *Chara* were also present; *Chara aspera* & *Chara virgata*. Other taxa present included; *Nuphar lutea, Nymphaea alba* and *Fontinalis antipyretica*. *Elodea canadensis* was present throughout the lough but nowhere did it dominate. A moderate diversity of marginal taxa were recorded including*; Alisma plantago-aquatica, Angelica sylvestris* and *Eleocharis palustris*. A total of 42 macrophyte taxa were recorded in this survey.

The NI lake survey (NILS) recorded a similar set of species at Lattone Lough as the current survey. *Potamogeton x nitens* was recorded in the NILS survey but not in the current survey and *P. gramineus, Nitella flexilis* and *Isoetes lacustris* were recorded in the current survey but not in the NILS survey. All other characteristic species were present in both surveys, suggesting that the site is stable floristically. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated form the NILS 1990 data (Table 137).

Negative indicator species

Elodea canadensis was recorded in 37.6% of sample plots. This is below the limit set by the CSM for sites with historical presence of the species. *E. canadensis* was also recorded in the 1990 NILS survey.

Table 137 Aquatic macrophyte community composition for Lattone Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=101)***
Charophytes	8.5	7.69	2	-	-	-
Chara aspera	-	-	-	8.5	7.69	10.9
Chara globularis globularis	8.5	7.69	1	-	-	-
Chara virgata	-	-	-	8.5	7.69	37.6
Elodea canadensis	8.5	7.95	3	8.5	7.95	27.7
Fontinalis antipyretica	6.3	5.38	3	6.3	5.38	20.8
Isoetes lacustris	**-**	**-**	**-**	**5**	**4.23**	**28.7**
Juncus bulbosus	3.7	3.08	1	-	-	-
Littorella uniflora	**6.7**	**4.23**	**4**	**6.7**	**4.23**	**8.9**
Lobelia dortmanna	**5**	**3.08**	**2**	**5**	**3.08**	**7.9**
Myriophyllum alterniflorum	5.5	4.23	2	5.5	4.23	5.9
Nitella flexilis	**-**	**-**	**-**	**5.5**	**5.38**	**15.8**
Nuphar lutea	8.5	6.92	2	8.5	6.92	2
Nymphaea alba	6.7	3.08	2	6.7	3.08	5.9
Potamogeton alpinus	**5.5**	**5.38**	**1**	**5.5**	**5.38**	**20.8**
Potamogeton berchtoldii	-	-	-	7.3	7.69	9.9
Potamogeton filiformis	10	7.69	2	10	7.69	44.6
Potamogeton gramineus	**-**	**-**	**-**	**7.3**	**7.31**	**18.8**
Potamogeton natans	6.7	4.23	3	6.7	4.23	3
Potamogeton pectinatus	-	-	-	10	8.85	18.8
Potamogeton perfoliatus	**7.3**	**7.69**	**3**	**7.3**	**7.69**	**2**
Potamogeton x nitens	**-**	**-**	**3**	**-**	**-**	**-**
Potamogeton pusillus	8.5	7.95	2	-	-	-
Sparganium angustifolium	**3**	**4.23**	**1**	**3**	**4.23**	**7.9**
Average score	**6.8**	**5**		**6.9**	**5.2**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Macrophyte community structure

Lattone lough sits within a catchment dominated by rough pasture with occasional small forestry plantations. Immediately surrounding the lake there is rough pasture and scrub. The border with the republic of Ireland crosses the lough from North West to South East.

The lough is bordered by a sporadic thin emergent fringe consisting of *E. palustris*, *S. lacustris P. australis*, *C. rostrata and E. fluviatile*. More commonly the emergent zone was dominated by *L. uniflora* which is predominantly in the shallows (0.25 m) and present up to 0.75 m. *L. dortmanna* present in slightly deeper water (0.5-0.75m) and *I. lacustris* present up to 2.2m. *M. alterniflorum* present from 0.25 -1 m. *C.*

aspera and *C. virgata* found sporadically at most vegetated depths. Several patches of Lilly (predominantly *N. lutea* but occasional *N. alba*). Diverse assemblage of *Potamogeton* spp. found at all vegetated depths. Predominantly *P. perfoliatus* in deeper water up to 1.7m. *P. natans* found at all depths. *P. filiformis* present in abundance at all depths in section 2. *E. canadensis* found up to 1.7 m, but nowhere dominant.

Water quality

Table 138 Water chemistry data for Lattone Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1990
TP	20.3	25.1	33.7	38.7	**29.5**	23
SRP	2.9	1.1	4.5	13	**5.4**	2
TN	0.55	0.63	0.72	0.69	**0.65**	0.72
TON	0.055	0.007	0.096	0.151	**0.077**	-
Nitrite	0.003	<0.001	<0.001	<0.001	**<0.001**	-
Chl *a*	5.50	12.32	4.29	0.80	**5.7**	10.1
DOC	8.12	8.8	9.6	8.7	**8.8**	-
pH	7.92	7.79	7.57	7.69	**7.72**	7.69
Alk	39	48	43	34	**41**	26
Cond	127	142	137	138	**136**	190
Ca^{2+}	13.9	18.9	17.1	14.3	**16.1**	20.6
Mg^{2+}	1.77	2.45	2.13	1.9	**2.06**	2.4
Na^{+}	9.15	9.3	9.25	11.4	**9.78**	10.6
K^{+}	1.12	1.14	1.35	1.28	**1.22**	1.15
Cl^{-}	17.1	15.2	16.9	21.6	**17.7**	24.9
SO_4^{2-}	<10	5.41	5.77	5.35	**<6.63**	8.76

Lattone Lough is a deeper (Z_{max} recorded = 14.5 m) lake with an annual mean TP (29.5 μgl^{-1}) which is above the guideline levels for mesotrophic (15 μgl^{-1}) lakes (JNCC 2015) and classifies it as "unfavourable" with respect to trophic status. Filamentous algal cover was also high and above guideline levels but Chlorophyll a amounts were low. The water column was well oxygenated (> 8 mgl^{-1}) down to 10m depth (Figure 31). DO dropped off rapidly below the thermocline to 0.18 mgl^{-1}.

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silt and sand.

Sediment load

The County River flows into Lattone Lough which originates from Lough Melvin a large mesotrophic lake. The dominant land cover in the catchment is rough pasture, forestry plantation and remnant peat bogs. Grazing and forestry operations are likely

to add to the sediment load, although there is little evidence of this in Lattone Lough. Cattle stocking levels appear low and the plantations are small and fragmented when compared to the large tracts of forest in areas such as Lough Navar.

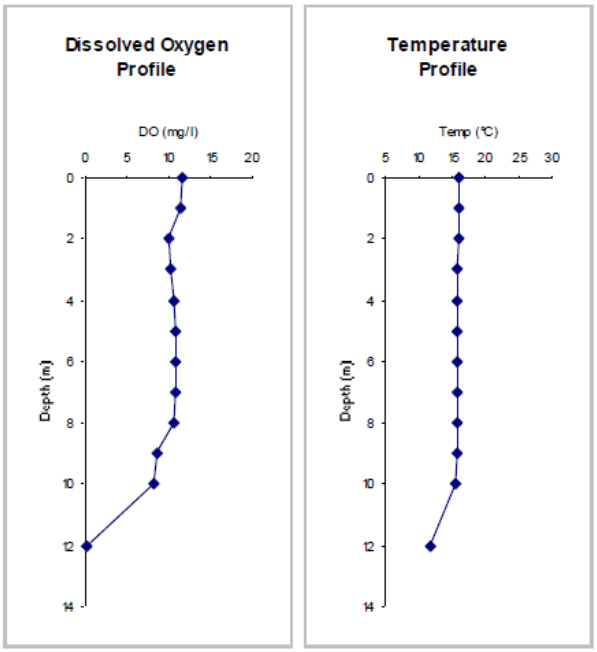
Figure 31 Dissolved oxygen and temperature profile for Lattone Lough (05/08/2014)

Dissolved Oxygen Profile

GPS Location	G9995145523
Maximum Depth (m)	14.5 m
Secchi Depth (cm)	120 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	11.54	16
1	11.3	16
2	10	15.9
3	10.25	15.8
4	10.5	15.8
5	10.8	15.8
6	10.77	15.8
7	10.86	15.8
8	10.68	15.8
9	8.6	15.7
10	8.11	15.4
12	0.18	11.7



Indicators of local distinctiveness

Potamogeton filiformis present. This species is normally associated with Eutrophic lakes but is present in Lattone Lough in abundance.

Summary

Lattone lough has a diverse and characteristic mesotrophic macrophyte assemblage. The current survey recorded 19 aquatic macrophyte species including 8 characteristic species (*3 x Potamogeton spp.,* 3 x Isoetid species, *S. angustifolium* and *N. flexilis*). These characteristic species were recorded in 76% of all sample plots. There is little change in the macrophyte fauna compared to the NILS 1990 survey. The dominant land cover is rough pasture but grazing appears to be low intensity. TP levels were above CSM guideline levels (JNCC 2015) and filamentous algal cover is high but chlorophyll a levels were low. Despite the high TP levels the macrophyte flora appears to be stable and unchanged since the NILS survey. *Elodea canadensis,* although present, is below levels deemed to be detrimental to the lakes ecology and have been present in the lake since the NILS survey. The macrophyte flora meets all criteria to meet favourable status. Therefore Lattone lough is classed as **Favourable, at risk.**

Table 139 Lattone Lough: Overview

Water Body	Status	Reason(s) for at risk	Comments
Lattone Lough NI Lake 694	**Favourable, at risk**	TP levels slightly high	Diverse and characteristic macrophyte flora that appears to be stable since the NILS survey. 3 Isoetid species present and 7 *Potamogeton* species.

Species list

Table 140 List of all plant species recorded at Lattone Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Alisma plantago-aquatica	R
Alnus glutinosa	O
Angelica sylvestris	R
Calluna vulgaris	R
Caltha palustris	R
Carex rostrata	R
Eleocharis palustris	R
Equisetum fluviatile	O
Filipendula ulmaria	R
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Juncus effusus	R
Mentha aquatica	R
Persicaria amphibia	R
Phragmites australis	R
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	O
Schoenoplectus lacustris	R
Succisa pratensis	R
Typha latifolia	R
Veronica beccabunga	R
Submerged & floating species	**% Frequency (n = 101)**
Chara aspera	9
Chara virgata	11
Elodea canadensis	38
Fontinalis antipyretica	28
Isoetes lacustris	21
Littorella uniflora	29
Lobelia dortmanna	9
Myriophyllum alterniflorum	8
Nitella flexilis	6
Nuphar lutea	16
Nymphaea alba	2
Potamogeton alpinus	6
Potamogeton berchtoldii	21
Potamogeton filiformis	10
Potamogeton gramineus	45
Potamogeton natans	19
Potamogeton pectinatus	3
Potamogeton perfoliatus	19
Sparganium angustifolium	2

Survey data

Site Condition Assessment: Lattone Lough (26/08/2014)

Lake Details		**Survey Details**		
Lake Name	Lattone Lough	Survey Date	26/08/2014	
SSSI Name		Surveyors	SD &HMG	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	H000454	Wader Surveys	4	4
WBID / NI No.	50032 / 776	Boat Surveys	4	sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	180 cm
		Compass bearing of boat transect (°)	139 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes: Phragmites dominated patch. Willows behind	
Section	**2**	Maximum depth of colonisation (cm)	160 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	30 m
		Notes: Start near inflow	
Section	**3**	Maximum depth of colonisation (cm)	170 cm
		Compass bearing of boat transect (°)	244 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Couldn't finish boat survey due to high winds.	
Section	**4**	Maximum depth of colonisation (cm)	210 cm
		Compass bearing of boat transect (°)	76 °
		Lateral distance from waters edge to 75cm depth (m)	8 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0000345093	G9991845035	G9996245079	G9994945092
Section	**2**	H0045545072	H0046845151	H0048145114	H0042145120
Section	**3**	G9978745567	G9973445650	G9976545611	G9977245627
Section	**4**	H0016545618	H0021145529	H0017745569	H0015945563

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0207	0206	0205
Section	**2**	212	211	213
Section	**3**	216	215	217
Section	**4**	220	219	218

3.27. Lough Ballydoolagh 812 (LA, Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* – assessed as mesotrophic.

Survey Date	03 July 2014
NI Lake Number:	812
WBID:	50091
County:	Fermanagh
Grid reference:	H285481
OS Grid reference (X,Y):	228470,348067
Shoreline development index:	1.255
Surface area (ha.):	18
Maximum recorded depth (m):	7.3

Table 141 Condition Assessment Summary Table for Ballydoolagh Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	**X**	3 characteristic broadleaf *Potamogeton* spp. (*P. alpinus, P. perfoliatus, P. praelongus*). 2 other characteristic species : *Littorella uniflora* & *Nitella flexillis* agg.
	No loss of characteristic species	✓	No loss of characteristic species since the 1988 survey.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	✓	74% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present in 77% of submerged plots.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Very little filamentous algae recorded (mostly 1s)
Macrophyte community structure	Characteristic vegetation zones should be present (see Table 4)	✓**?**	Some areas of fringing emergent vegetation (*S. lacustris*, *C. rostrata* and *E. palustris*.), giving way to deciduous hedges and rough pasture. Other areas with little in the way of emergent vegetation dominated by *L. uniflora* in the shallows. The submerged & floating leaved taxa occur in distinct zones (S1). *N. lutea* & *N. alba* fringe some areas up to 1m. A zone of predominantly broad leaved *Potamogeton* spp occurs between 0.75 – 1.1m. A zone of *Callitriche* sp. occurs between 1.4-1.7m with *Chara* sp. and *Nitella* sp. present at 1.7m. *E. canadensis* and *P. berchtoldii* at most vegetated depths at varying frequencies.
	Maximum depth distribution should be maintained	✓	Z_{max} = 7.3 m, Z_s = 2.0 m, Z_v = 2.3 m.
	At least the present structure should be maintained	✓	
Water quality	Stable nutrients levels: TP target / limit: Mesotrophic = 15 μgl^{-1}	**X**	TP = 38 μgl^{-1} (range 27-55) & TN = 0.95 mgl^{-1} (April '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓**?**	pH = 7.81 (range = 7.73 – 7.96).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	**X**	Surface waters well oxygenated, but dropping to a mean of 1.5 m mgl^{-1} below the thermocline at 5 m.
	No excessive growth of cyanobacteria or green algae	✓	None recorded
Hydrology	Natural hydrological regime	**X**	Raised/natural. Former reservoir, disused for some time, a natural regime appears to be in place. Dam at the northern end of the lake.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓?	Natural apart from the northern shore which is dammed
	Natural and characteristic substrate maintained	✓	Predominantly sandy substrate with boulders and cobbles. Silty substrate near the inflow.
Sediment load	Natural sediment load maintained	✓	Appears normal
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓?	Grazing pressure a possible concern.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 18 ha with no loss of extent to the open water.

Macrophyte community composition

Ballydoolagh Lough lies within a catchment of rough pasture, small copses and peat. In terms of mesotrophic species, 3 characteristic *Potamogeton* spp. were recorded (*P. perfoliatus*, *P. alpinus* and *P. praelongus*). Two other characteristic species were present (*Nitella flexilis agg*. & *Littorella uniflora*). At least 1 of the characteristic species were present in 74% of the submerged survey plots. Other submerged and floating-leaved aquatic macrophyte taxa growing in the lough included: *Chara virgata*, *Chara globularis*, *Elodea canadensis, Nuphar lutea, Nymphaea alba & Persicaria amphibia.* Marginal emergent vegetation included *Sparganium erectum*, *Carex rostrata, Equisetum fluviatile, Eleocharis palustris, Juncus acutiflorus, Juncus effuses* & *Ranunculus flammula*, giving way to deciduous hedges including *Salix sp.* and *Alnus glutinosa* and rough pasture beyond.

Species recorded in the 1988 NILS survey but absent from the 2014 survey were *Myriophyllum alterniflorum, Potamogeton obtusifolius* and *Apium inundatum*. Species recorded in 2014 but not in 1988 were *Chara globularis*, *Chara virgata*, *Nitella flexilis agg., Nymphaea alba* and *Lemna trisulca*. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site (Table 142) are comparable to those calculated from the 1988 suggesting limited change in trophic status over the past 26 years.

Negative indicator species

Elodea canadensis was recorded at a high frequency (74%) which exceeds the CSM threshold (50%) and classifies the site as unfavourable in accordance with the original CSM guidance (JNCC 2005), and more generally with non-native species in the updated version (JNCC 2015) which classifies the presence of any high-impact species as unfavourable.

Table 142 Aquatic macrophyte community composition for Ballydoolagh Lough, 2014 including trophic scores

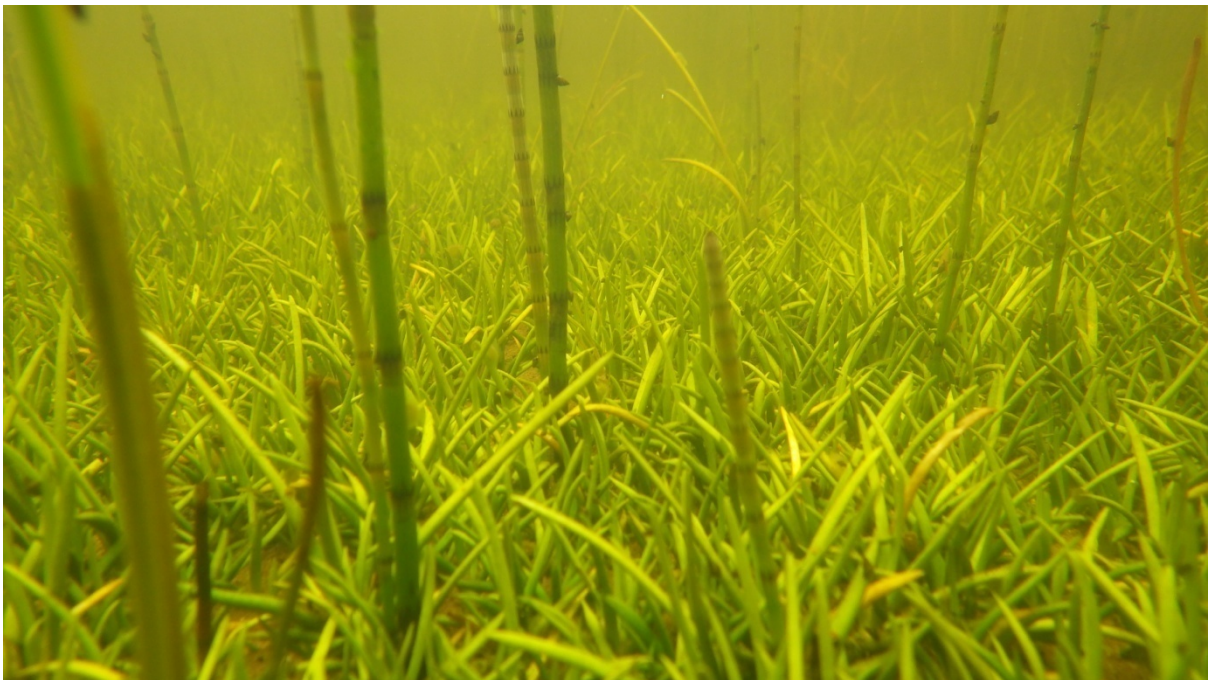
	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=113)***
Apium inundatum	7.0	7.5	1	-	-	-
Callitriche sp.	-	-	1	-	-	4.4
Callitriche stagnalis	7.7	7.69	1	-	-	-
Chara virgata	-	-	-	8.5	7.69	0.9
Chara globularis	-	-	-	8.5	7.69	0.9
Elodea canadensis	8.5	7.95	3	8.5	7.95	77
Fontinalis antipyretica	6.3	5.38	2	-	-	-
Lemna minor	9.0	8.85	2	9.0	8.85	+
Lemna trisulca	-	-	-	10.0	8.85	4.4
Littorella uniflora	**6.7**	**4.23**	**5**	**6.7**	**4.23**	**39.8**
Myriophyllum alterniflorum	5.5	4.23	1	-	-	-
***Nitella flexilis* agg.**	**-**	**-**	**-**	**5.5**	**5.38**	**0.9**
Nuphar lutea	8.5	6.92	2	8.5	6.92	2.7
Nymphaea alba	-	-	-	6.7	3.08	5.3
Persicaria amphibia	9.0	7.95	2	9.0	7.95	3.5
Potamogeton alpinus	**5.5**	**5.38**	**3**	**5.5**	**5.38**	**31.9**
Potamogeton berchtoldii	7.3	7.69	5	7.3	7.69	46.9
Potamogeton obtusifolius	7.3	6.54	3	-	-	-
Potamogeton perfoliatus	**-**	**-**	**-**	**7.3**	**7.69**	**8.8**
Potamogeton praelongus	**7.3**	**5.38**	**3**	**7.3**	**5.38**	**1.8**
Sparganium emersum	10.0	7.50	**3**	10.0	7.5	+
Average score	**7.5**	**6.88**		**7.9**	**6.88**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Nowhere around Ballydoolagh lough was the emergent and fringing vegetation dense, where present, it mostly consisted of *Schoenoplectus lacustris*, *Carex rostrata* and *Eleocharis palustris*. Other areas of the lake shore consisted of mainly *Littorella lacustris* alongside *Equisetum fluviatile* (see Figure 32). Patches of *Nuphar lutea* and *Nymphaea alba* occur around the lough up to the >75cm submerged sample plot. The boat transect in section 1 revealed clear zonation of macrophyte taxa with a zone of broadleaved *Potamogeton* species, dominated by *P. alpinus*, growing between 0.75-1.2m depth. A zone of abundant *Callitriche* sp. was present at 1.4 – 1.7m depth. *Chara* spp. and *Nitella flexillis* agg. occurred beyond this *Callitriche* sp. zone, with *Elodea canadensis* and *P. berchtoldii* found at all vegetated depths. The other two boat transects recorded less defined zonation with only 3 species present, *E. canadensis* being dominant.

Figure 32 *Littorella uniflora* and *Equisetum fluviatile* growing in Ballydoolagh Lough. 2014



Water quality
Total phosphorus is higher than the target level set in the CSM guidelines for this lake type (15 μgl^{-1} JNCC 2015). Although unfavourable with respect to trophic status, the lough shows limited direct evidence of the effects of nutrient enrichment: i.e. filamentous algae cover is low and Chl *a* is low. Other water quality parameters are consistent with the lake type (i.e. mesotrophic, LA Sh). At the time of survey, the surface waters were well oxygenated, but the lake was stratified and had very low DO below the thermocline at approximately 5.0 m (mean DO = 1.5 mgl^{-1}).

Hydrology
Ballydoolagh Lough has several small inflow streams draining from the surrounding agricultural catchment set in rolling hills. The outflow has been dammed and the lough has historically been used as a water supply reservoir. It appears to no longer to be used for this purpose and no drawdown zone is apparent which is often a negative feature of reservoirs. Assuming water levels are relatively stable, the current hydrology is favourable.

Lake substrate
At the margins the lake substrates are predominantly a mixture of sand, cobbles, pebbles and silt. The open waters are predominantly silt substrates.

Sediment load
It was noted that the substrates near the inflow at section 1 were heavy silt. This is the exception as most areas of the lough do not suffer from notable increase in sediment load for this type of lake.

Indicators of local distinctiveness
None specified.

Table 143 Water chemistry data for Ballydoolagh Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	30.9	27.8	39.7	55.1	**38.0**	31
SRP	5.5	<1.0	16.6	35.0	**14.5**	19
TN	0.86	0.75	0.91	1.27	**0.95**	0.79
TON	0.2	<0.005	0.132	0.571	**<0.227**	-
Nitrite	0.005	<0.001	0.004	0.005	**<0.004**	-
Chl *a*	3.85	0.11	1.25	1.76	3.85	34.5
DOC	7.08	7.81	8.36	7.57	**7.71**	-
pH	7.73	7.96	7.75	7.85	**7.71**	8.46
Alk	54	65	59	50	**57**	28.4
Cond	146	149	156	158	**152**	163
Ca^{2+}	20	20.9	22.2	20.1	**20.8**	15
Mg^{2+}	2.3	2.48	2.57	2.45	**2.45**	2.4
Na^{+}	6.81	6.93	7.32	8.52	**7.40**	8.85
K^{+}	1.79	1.67	2.1	2.04	**1.90**	1.7
Cl^{-}	13.1	12.3	12.5	16.5	**13.6**	14.6
SO_4^{2-}	<10	5.33	5.93	6.14	**<6.85**	5.7

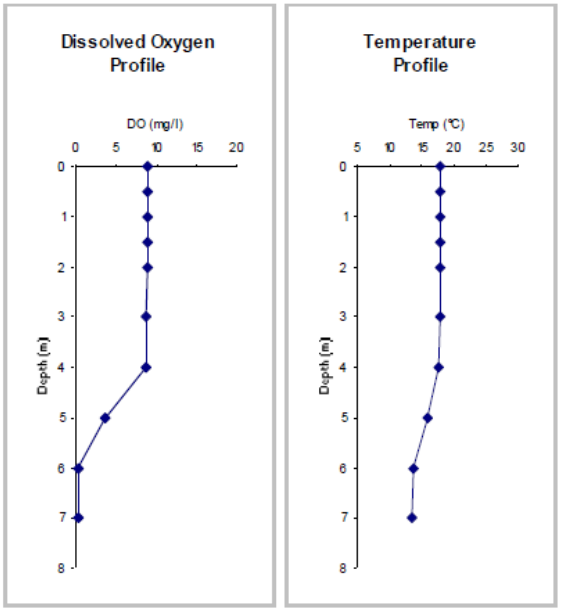
Figure 33 Dissolved oxygen and temperature profile for Ballydoolagh Lough (03/07/2014)

Dissolved Oxygen Profile

GPS Location	H2853848148
Maximum Depth (m)	7.3 m
Secchi Depth (cm)	200 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	9.01	17.8
0.5	8.98	17.8
1	8.95	17.8
1.5	8.95	17.8
2	8.89	17.8
3	8.8	17.8
4	8.8	17.6
5	3.6	15.9
6	0.4	13.7
7	0.45	13.4



Summary

Ballydoolagh Lough is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*” but the plant assemblage and water quality place it towards the mesotrophic end of this classification. The lake has a neutral pH, moderate levels of nutrients and floral characteristic of a mesotrophic lake, although it falls short of the number of species required to meet favourable status under CSM guidelines (JNCC 2015).

The TP levels are above the guideline levels for mesotrophic lakes (15-20 μgl^{-1}). This elevated nutrient load is mostly likely the result of long-term diffuse inputs from the sheep and cattle farming within the catchment. There was no evidence of any other direct inputs at the time of the survey and the site does not exhibit signs typical of eutrophication such as high filamentous algal cover and high chlorophyll a.

The flora of the site contains 5 characteristic species including 3 broadleaved *Potamogeton* species (*P. alpinus*, *P. praelongus* & *P. perfoliatus*) as well as *Littorella uniflora* and *Nitella flexilis agg. Littorella uniflora* in particular grows at high abundance in some areas of the lough (Figure 32) and is the dominant plant in the shallow water (0 - 0.50m). *Elodea canadensis* dominated the site however and grows well above the threshold level that is considered favourable. Despite the TP and floristics not quite meeting the CSM guidance (JNCC 2015) the lough is still a good example of a mesotrophic system and one which appears to be stable when compared to past records. Given the lough sits within a catchment almost solely consisting of sheep and cattle grazing and with the nutrient inputs normally associated with this type of land use, the stability and diversity of the flora is surprising. This probably reflects the relatively low intensity of much of the farming in the area.

Ballydoolagh Lough is however classed as **unfavourable** as if fails to meet a number of targets under the CSM guidance (JNCC 2015). Given the apparent stability of the lough, a reduction in TP and *E. canadensis* cover may be sufficient to raise the status to favourable, at risk category.

Table 144 Ballydoolagh Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Ballydoolagh Lough NI Lake 812	**Unfavourable**	Above target TP, High *E. canadensis* cover and insufficient number of characteristic species.	Despite failure, a reasonably good example of a mesotrophic lake in an agricultural catchment. Disused reservoir dammed at the outflow but with a seemingly natural hydrology. Flora is similar to that recorded in the 1980’s (NILS).

Species list

Table 145 List of all plant species recorded at Ballydoolagh Lough in

Marginal & Emergent species	**Abundance (DAFOR)**
Alnus glutinosa	O
Angelica sylvestris	R
Carex rostrata	R
Eleocharis palustris	O
Epilobium hirsutum	R
Equisetum fluviatile	R
Equisetum palustre	R
Filipendula ulmaria	R
Galium palustre	O
Hypericum tetrapterum	R
Juncus acutiflorus	R
Juncus effusus	R
Lythrum salicaria	R
Mentha aquatica	R
Myosotis laxa	R
Nuphar lutea	R
Ranunculus flammula	R
Salix sp.	R
Senecio aquaticus	R
Sparganium erectum	R
Veronica beccabunga	R
Submerged & floating species	**% Frequency (n = 113)**
Callitriche sp.	4
Chara virgata	1
Chara globularis	1
Elodea canadensis	77.
Lemna minor	+
Lemna trisulca	4
Littorella uniflora	40
Nitella flexilis agg.	1
Nuphar lutea	3
Nymphaea alba	5
Persicaria amphibia	4
Potamogeton alpinus	32
Potamogeton berchtoldii	47
Potamogeton perfoliatus	9
Potamogeton praelongus	2
Sparganium emersum	+

Survey data

Site Condition Assessment: Ballydoolagh Lough (03/07/2014)

Lake Details		**Survey Details**		
Lake Name	Ballydoolagh Lough	Survey Date	03/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	H285481	Wader Surveys	4	4
WBID / NI No.	50091 / 812	Boat Surveys	4	sections

Site Notes:

Survey Notes:
Dam at one end and modified bank next to road

Section Summaries

Section 1

Maximum depth of colonisation (cm)	230 cm
Compass bearing of boat transect (°)	169 °
Lateral distance from waters edge to 75cm depth (m)	10 m

Notes: silty substrate near inflow

Section 2

Maximum depth of colonisation (cm)	160 cm
Compass bearing of boat transect (°)	51 °
Lateral distance from waters edge to 75cm depth (m)	3 m

Notes: very windy, cobble substrate anchoring difficult

Section 3

Maximum depth of colonisation (cm)	190 cm
Compass bearing of boat transect (°)	264 °
Lateral distance from waters edge to 75cm depth (m)	1 m

Notes:

Section 4

Maximum depth of colonisation (cm)	-
Compass bearing of boat transect (°)	28 °
Lateral distance from waters edge to 75cm depth (m)	1 m

Notes: Windy. No plants in boat survey.

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H2860447787	H2831947737	H2856347761	H2851847837
Section 2	H2866648141	H2859048206	H2862848172	H2860048168
Section 3	H2834147962	H2831448058	H2832348010	H2833648032
Section 4	H2839748288	H2831348341	H2835148307	H2834448290

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0159	0160	0161
Section 2	0165	0167	0168
Section 3	0169	0170	0171
Section 4	0172	0173	0174

3.28. Watson's Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	08 July 2014
NI Lake Number:	816
WBID:	50408
County:	Fermanagh
Grid reference:	H307495
OS Grid reference (X,Y):	230665,349546
Shoreline development index:	1.139
Surface area (ha.):	4.7
Maximum recorded depth (m):	1.65

Table 146 Condition Assessment Summary Table for Watsons Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Mesotrophic: ≥ 8 Characteristic species	**X**	Only 2 characteristic species present: *N. flexillis,* and *P. alpinus*
	No loss of characteristic species	✓	No loss of characteristic species since the NILS survey although *N. alba* and *N. peltata* present in the NILS survey but not in the current survey.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	68% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	**x**	*E. canadensis* present in 86.2% of vegetated sample plots.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	2% points score a 3 for filamentous algae
Macrophyte community structure	Characteristic vegetation zones should be present	**x**	On the eastern shore the Lough there was a dense zone of *P. australis,* extending for approximately 30 m from lake shore into the lake. Around the rest of the lough the emergent vegetation was sparse and mainly consisted of *C. rostrata* and *E. fluviatile* with occasional *T. latifolia*. Beyond the reed fringe a sparse zone of *N. lutea* is present up to 0.75 m depth. Growing amongst the lily fringe and beyond was *E. canadensis, P. obtusifolius, P. alpinus*, *N. flexilis agg*. and *F. antipyretica.* Macrophytes grew throughout the lough at all depths (up to 1.6m). Both *P. berchtoldii* and *M. alterniflorum* only found in the strandline survey. Marginal species included: *C. palustris, R. flammula* and *V. catenata*. A comprehensive taxa list is given in table 5.
	Maximum depth distribution should be maintained	✓	Z_{max} = 1.65 m, Z_s = 1.65 m, Z_v = 1.65 m.
	At least the present structure should be maintained	✓**?**	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Mesotrophic = 20 µgl^{-1}	**X**	TP = 25.9 µgl^{-1} (range 21 - 43) & TN = 0.98 mgl^{-1} (Apr '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.02 (range = 6.6 – 7.8).
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	✓	Waters well oxygenated: DO >10.4 mgl^{-1} throughout water column. No thermocline

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	Mainly silt substrates
Sediment load	Natural sediment load maintained	✓	The lough sits within a catchment consisting of rough and improved pasture. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None present
	Minimal negative impacts and no fish farming	✓	

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 4.7 ha, with no loss of extent of open water.

Macrophyte community composition

Watsons Lough is classified under the H3130: Oligotrophic to mesotrophic standing waters. It has a poor assemblage of aquatic macrophyte taxa with only two characteristic species recorded in the current survey (*Potamogeton alpinus* and *Nitella flexilis* agg.). Nine other aquatic species were recorded (*Elodea canadensis,* Fontinalis *antipyretica, Lemna minor, Lemna trisulca, Nuphar lutea, Potamogeton obtusifolius, Sparganium emersum, Myriophyllum alterniflorum* and *Potamogeton berchtoldii*). Emergent species present were; *C. rostrata, E. fluviatile*, and *J. acutiflorus*. A comprehensive taxa list is given in Table 150.

The NI lake survey (NILS) recorded a similar set of species at Watsons Lough as the current survey. The only difference's in terms of characteristic species was the presence of *N. flexillis agg.* in the current survey but absence in the NILS survey. Both *Nymphaea alba* and *Nymphoides peltata* were recorded in the NILS survey but were absent from the current survey. All other aquatic taxa recorded in the NILS survey were recorded in the current survey. *Elodea canadensis* was present in the NILS as it was in the recent survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated from the NILS 1990 data.

Negative indicator species

Elodea canadensis was recorded in 86.2% of all survey plots. In the NILS 1980's survey of this site *E. canadensis* was recorded at abundance 5 in a scale of up to 5. Given the methodological differences of both surveys its hard to make comparisons but it is safe to assume that the cover of *E. canadensis* has not increased since the NILS survey. The presence of a well established population of this non-native species is unfavourable under CSM guidance (JNCC 2015).

Table 147 Aquatic macrophyte community composition for Watsons Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=62)***
Elodea canadensis	8.5	7.95	**5**	8.5	7.95	86.2
Fontinalis antipyretica	6.3	5.38	1	6.3	5.38	6.2
Lemna minor	9.0	8.85	2	9.0	8.85	6.2
Lemna trisulca	-	-	-	10.0	8.85	12.3
Myriophyllum alterniflorum	5.5	4.23	3	5.5	4.23	+
Nitella flexilis agg.	**-**	**-**	**-**	**5.5**	**5.38**	**29.2**
Nuphar lutea	8.5	6.92	1	8.5	6.92	23.1
Nymphaea alba	6.7	3.08	2	-	-	-
Nymphoides peltata	-	-	+	-	-	-
Potamogeton alpinus	**5.5**	**5.38**	**4**	**5.5**	**5.38**	**52.3**
Potamogeton berchtoldii	-	-	**-**	7.3	7.69	+
Potamogeton obtusifolius	7.3	6.54	3	7.3	6.54	33.8
Sparganium emersum	10.0	7.50	2	10.0	7.50	27.4
Average score	**7.5**	**6.2**		**7.6**	**6.8**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Macrophyte community structure

On the eastern shore the Lough there was a dense zone of *P. australis*, extending for approximately 30 m from lake shore into the lake. Around the rest of the lough the emergent vegetation was sparse and mainly consisted of *C. rostrata* and *E. fluviatile* with occasional *T. latifolia*. Beyond the reed fringe a sparse zone of *N. lutea* is present up to 0.75 m depth. Growing amongst the lily fringe and beyond was *E. canadensis, P. obtusifolius, P. alpinus, N. flexilis* agg. and *F. antipyretica*. Macrophytes grew throughout the lough at all depths (up to 1.6m). Both *P. berchtoldii* and *M. alterniflorum* only found in the strandline survey. Marginal species included: *C. palustris, R. flammula* and *V. catenata*. A comprehensive taxa list is given in Table 150.

Water quality

Watson's Lough is a very shallow (Z_{max} recorded = 1.6 m) mesotrophic lake with an annual mean TP (25.9 μgl^{-1}) which is above the guideline levels for a mesotrophic (20 μgl^{-1}) lake (JNCC 2015) and classifies it as "unfavourable" with respect to trophic status. Filamentous algal cover was low in the wader survey but above 10% in the boat survey. Chlorophyll a amounts were low. The water column was well oxygenated (> 10.4 mgl^{-1}) throughout the water column. (Figure 34)

Table 148 Water chemistry data for Watson's Lough

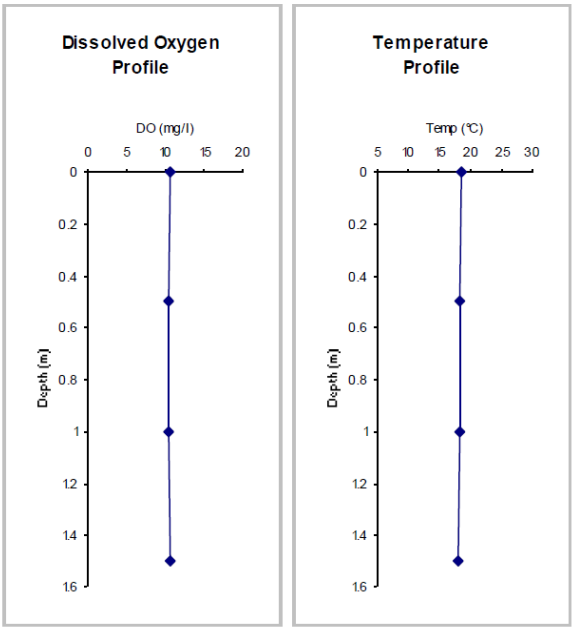
	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1990
TP	21.4	23.2	42.9	16.2	**25.9**	12
SRP	3.5	2.4	5.7	5.3	**4.2**	7
TN	0.69	0.83	1.39	0.99	**0.98**	1.48
TON	<0.005	0.007	0.118	0.47	**<0.15**	-
Nitrite	<0.001	<0.001	<0.001	0.003	**<0.002**	-
Chl *a*	2.20	1.65	2.42	1.54	**1.95**	4.27
DOC	9.68	10.4	17.5	7.29	**11.22**	-
pH	7.67	7.77	6.57	7.13	**7.02**	7.43
Alk	66	68	34	40	**52**	27.6
Cond	155	153	108	157	**143**	162
Ca^{2+}	23.5	23.4	12.9	18.4	**19.6**	18.9
Mg^{2+}	2.66	2.95	2.1	2.72	**2.61**	2.5
Na^{+}	7.06	6.74	7.48	9.91	**7.80**	8.0
K^{+}	0.943	0.206	1.75	1.51	**1.10**	1.2
Cl^{-}	11.2	9.7	13.3	22.3	**14.1**	18.26
SO_4^{2-}	<10	3.73	6.07	5.3	**<6.28**	6.22

Figure 34 Dissolved oxygen and temperature profile for Watsons Lough (08/07/2014)

Dissolved Oxygen Profile

GPS Location	H3064249539
Maximum Depth (m)	1.65 m
Secchi Depth (cm)	165 cm
Notes:	sechi disk hit bottom

Depth (m)	DO (mg/l)	Temp (°C)
0	10.56	18.5
0.5	10.46	18.3
1	10.5	18.2
1.5	10.7	18.1



Hydrology

The hydrological regime at the site appears natural.

Lake substrate
The lake basin is predominantly silt and sand.

Sediment load
Watson's Lough is surrounded by rough pasture and improved pasture. Much of the pasture is drained peat bog. Stocking rates of cattle appears to be low with limited negative impacts such as poaching at the lough shore.

Indicators of local distinctiveness
None present.

Summary
Watsons Lough is an example of a mesotrophic lake, with an impoverished characteristic flora and poor water chemistry. The current survey recorded only two characteristic species, both of which were common in the site with one or both present in 68% of all sample plots. There is little change in the macrophyte flora compared to the NILS 1990 survey. The dominant land cover is rough and improved pasture. TP levels were above CSM guideline levels (JNCC 2015) as was filamentous algal cover. Chlorophyll a levels were low. Given the low number of characteristic species and uncharacteristic water chemistry Watsons Lough is classed as being in an **Unfavourable** condition.

Table 149 Watson's Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Watson's Lough NI Lake 816	**Unfavourable**	Less that the target number of characteristic species for a mesotrophic lake. TP exceeds target levels High frequency of *E. canadensis*	*N. alba* and *N. peltata* absent from the current survey, present in the NILS survey.

Species list

Table 150 List of all plant species recorded at Watson's Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Alnus glutinosa	R
Angelica sylvestris	R
Caltha palustris	R
Carex echinata	R
Carex rostrata	O
Equisetum fluviatile	F
Filipendula ulmaria	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Juncus effusus	R
Lychnis flos-cuculi	R
Mentha aquatica	R
Nuphar lutea	O
Pedicularis palustris	R
Phragmites australis	R
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	O
Senecio aquaticus	R
Typha latifolia	R
Veronica catenata	R
Submerged & floating species	**% Frequency (n = 62)**
Elodea canadensis	86
Fontinalis antipyretica	6
Lemna minor	6
Lemna trisulca	12
Myriophyllum alterniflorum	+
Nitella flexilis agg.	29
Nuphar lutea	23
Potamogeton alpinus	52
Potamogeton berchtoldii	+
Potamogeton obtusifolius	34
Sparganium emersum	27

Survey data

Site Condition Assessment: Watson's Lough (08/07/2014)

Lake Details		**Survey Details**		
Lake Name	Watson's Lough	Survey Date	08/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H307495	Wader Surveys	2	2
WBID / NI No.	50265 / 816	Boat Surveys	2	sections

Site Notes:

Survey Notes:
Shallow Lake plant growth throughout. Difficult to access margin on section 2, extremely unstable quaking bank

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	140 cm
		Compass bearing of boat transect (°)	110 °
		Lateral distance from waters edge to 75cm depth (m)	8 m
		Notes: boat survey, no outer limit of plant growth	
Section	**2**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	305 °
		Lateral distance from waters edge to 75cm depth (m)	15 m
		Notes: no outer extent of plants on boat transect.	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H3057549544	H3061149633	H3058649596	H3064843563
Section	**2**	H3069849541	H3065449448	H3070049492	H3063649495

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0232	0236	0237
Section	**2**	0238	0251	0252

3.29. Nayre Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	29 July 2014
NI Lake Number:	937
WBID:	50174
County:	Fermanagh
Grid reference:	H398338
OS Grid reference (X,Y):	239771,333840
Shoreline development index:	1.166
Surface area (ha.):	8.0
Maximum recorded depth (m):	12.4

Table 151 Condition Assessment Summary Table for Nayre Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓?	2 characteristic species present: *L. uniflora,* and *Baldellia ranunculoides*
	Mesotrophic: ≥ 8 characteristic species	X	5 characteristic species present: As above and *N. flexilis, P. perfoliatus* & *P. praelongus*

Attribute	Target	Status	Comment
	No loss of characteristic species	✓	Gain of 2 characteristic species (*P. praelongus and B. ranunculoides*) since the NILS survey.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X** **X**	6% of vegetated sample spots comply for oligotrophic species. 39% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	**X**	*E. canadensis* present in 21% of vegetated sample plots. Also present in the NILS survey.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Small amount (<5%) of filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Around most of the lough emergent vegetation is sparse. Where it occurs it consists of *C. rostrata*, *E. palustris* and *E. fluviatile* with occasional dense patches of *P. australis* and *S. lacustris*. *B. ranunculoides* emergent in section 1 and *J. bulbosus* recorded off transect near section 1. *L. uniflora* submerged between 0 – 0.5 m. *M. alterniflorum* common at depths 0.25 – 2.4 m. *C. virgata* present in the shallows and up to 1.9 m. *N. flexillis* recorded once in section 2 at 1.6 m. *P. berchtoldii* and *P. obtusifolius* mainly found in the wader survey. A zone of *P. perfoliatus* between 1 – 2.4 m succeeded in deeper water (up to 3.1 m) by *P. praelongus*.
	Maximum depth distribution should be maintained	✓	Z_{max} = 12.4 m, Z_s = 3.25m, Z_v = 3.10 m.
	At least the present structure should be maintained	✓**?**	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1} Mesotrophic = 15 µgl^{-1}	 ✓**?** ✓	TP = 10.1 µgl^{-1} (range 8.5-11.2) & TN = 0.48 mgl^{-1} (May '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.73 (range = 7.6 – 8.1).

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	X	Waters well oxygenated: DO >7.8 mgl^{-1} >3 m. Mean DO below the thermocline (0.93 mgl^{-1})
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of silt and sand substrates at the margins, with occasional boulders and cobbles.
Sediment load	Natural sediment load maintained	✓	The lough sits within a catchment consisting of forestry and rough pasture. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	
	Minimal negative impacts and no fish farming	✓?	Shore angling. New fishing platforms constructed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 8 ha, with no loss of extent of open water.

Macrophyte community composition

Nayre Lough has a moderately diverse assemblage of macrophyte taxa and is classified under the H3130: Oligotrophic to mesotrophic standing waters. Given the presence of a number of characteristic mesotrophic species (*Baldellia ranunculoides, Littorella uniflora, Potamogeton perfoliatus* and *Potamogeton praelongus*) and other taxa which are associated with higher nutrients (Nuphar lutea and Lemna minor), it is deemed that Nayre lough is mesotrophic. This survey recorded 16 aquatic species, five of which were characteristic mesotrophic species (JNCC 2015). Five species of *Potamogeton* were recorded (*Potamogeton berchtoldii, Potamogeton natans, P. perfoliatus, P. praelongus* and *Potamogeton obtusifolius*). Two Charophyte species were recorded (*Chara virgata* and *Nitella flexilis*). Emergent species present were; *C. rostrata, E. palustris, E. fluviatile,* and *J. acutiflorus*. A comprehensive taxa list is given in Table 155.

The NI lake survey (NILS) recorded a very similar set of species at Nayre Lough as the current survey. The only difference's in terms of characteristic species was the presence of *P. praelongus* in the current survey but absence in the NILS survey. *E. canadensis* was present in the NILS as it was in the recent survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated from the NILS 1988 data (Table 152).

Negative indicator species

E. canadensis was recorded in 21% of all survey plots. In the NILS 1980's survey of this site *E. canadensis* was recorded at abundance 4 in a scale of up to 5. Given the methodological differences of both surveys it is hard to make comparisons but it is safe to assume that *E. canadensis* has been a significant element of the aquatic flora since the NILS survey. The presence of this non-native species is unfavourable under CSM guidance (JNCC 2015).

Table 152 Aquatic macrophyte community composition for Nayre Lough, including trophic scores

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=62)***
Baldellia ranunculoides	**-**	**-**	**-**	**4.0**	**-**	**1.6**
Charophytes	8.5	7.69	2	-	-	-
Chara virgata	-	-	-	8.5	7.69	35.5
Elodea canadensis	8.5	7.95	4	8.5	7.95	21
Fontinalis antipyretica	6.3	5.38	1	6.3	5.38	6.5
Juncus bulbosus	-	-	-	3.7	3.08	+
Lemna minor	-	-	-	9.0	8.85	1.6
Littorella uniflora	**6.7**	**4.23**	**5**	**6.7**	**4.23**	**4.8**
Mosses aquatic	-	-	-	-	-	1.6
Myriophyllum alterniflorum	5.5	4.23	5	5.5	4.23	64.5
Nitella flexilis	**5.5**	**5.38**	**+**	**5.5**	**5.38**	**1.6**
Nuphar lutea	8.5	6.92	2	8.5	6.92	8.1
Potamogeton berchtoldii	-	-	-	7.3	7.69	4.8
Potamogeton natans	6.7	4.23	2	6.7	4.23	8.1
Potamogeton obtusifolius	7.3	6.54	4	7.3	6.54	17.7
Potamogeton perfoliatus	**7.3**	**7.69**	**3**	**7.3**	**7.69**	**27.4**
Potamogeton praelongus	**-**	**-**	**-**	**7.3**	**5.38**	**16.1**
Average score	**7.7**	**6.88**		**7.9**	**6.88**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Macrophyte community structure

Nayre Lough sits within a catchment of mainly rough pasture with a conifer plantation lying to the North of the lough.

Emergent vegetation was sporadic; in places it was dense with *P. australis* and *S. lacustris* but more commonly it consisted of a thin fringe of *E. fluviatile, E. palustris* and *C. rostrata*. In places the emergent zone inhabited by *L. uniflora* which was

predominantly in the shallows (0.25-0.5 m). Occasional *J. bulbosus* were present in the shallows (25 cm). *Myriophyllum alterniflorum* was common at depths 0.25 – 2.4 m. *Chara virgata* was present in the shallows and up to 1.9 m. *Nitella flexillis* was recorded once in section 2 at 1.6 m. *P. berchtoldii* and *P. obtusifolius* were mainly found in the wader survey. A zone of *P. perfoliatus* between 1 – 2.4 m was succeeded in deeper water (up to 3.1 m) by *P. praelongus*.

Water quality

Nayre Lough is a shallow (Z_{max} recorded = 12.4 m) mesotrophic lake with an annual mean TP (10.1 μgl^{-1}) which is within the guideline levels for a mesotrophic (15 μgl^{-1}) lake (JNCC 2015) and classifies it as "favourable" with respect to trophic status. Filamentous algal cover was low, as was Chlorophyll *a*. The water column was well oxygenated (> 7.8 mgl^{-1}) above 3 m depth (Figure 35), although below the thermocline the mean DO was 0.93 mgl^{-1} which is below guideline levels (JNCC 2015).

Table 153 Water chemistry data for Nayre Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	11	8.5	11.2	10	10.1	12
SRP	1.9	<1.0	1.2	2.4	<1.63	0
TN	0.44	0.44	0.49	0.53	0.48	0.51
TON	0.009	<0.005	0.025	0.167	<0.052	-
Nitrite	<0.001	<0.001	0.003	<0.001	<0.002	-
Chl *a*	4.95	2.06	1.87	1.39	2.57	4.6
DOC	5.94	6.75	6.24	6.92	6.46	-
pH	8.14	7.74	7.59	7.63	7.73	8.02
Alk	44	52	55	47	49.5	23.6
Cond	131	151	147	138	142	141
Ca^{2+}	16.1	17.4	17.7	16.7	17.0	20.6
Mg^{2+}	3.4	3.76	3.83	3.49	3.62	2.9
Na^{+}	7.74	8.31	8.5	8.29	8.21	6.5
K^{+}	1.03	1	1.08	1.04	1.04	0.3
Cl^{-}	10.5	11.4	11.9	11.5	11.3	13.3
SO_4^{2-}	<10	9.73	9.3	9.49	<9.63	14.6

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silt and sand.

Sediment load

Nayre Lough is surrounded by forestry rough pasture. Forest operations, such as clearfell, within a catchment can add to the sediment load of a lake. Little evidence of recent forest operations within the immediate vicinity of the lough was apparent at

the time of the survey. Stocking rates of cattle appears to be low with limited negative impacts such as poaching at the lough shore.

Indicators of local distinctiveness

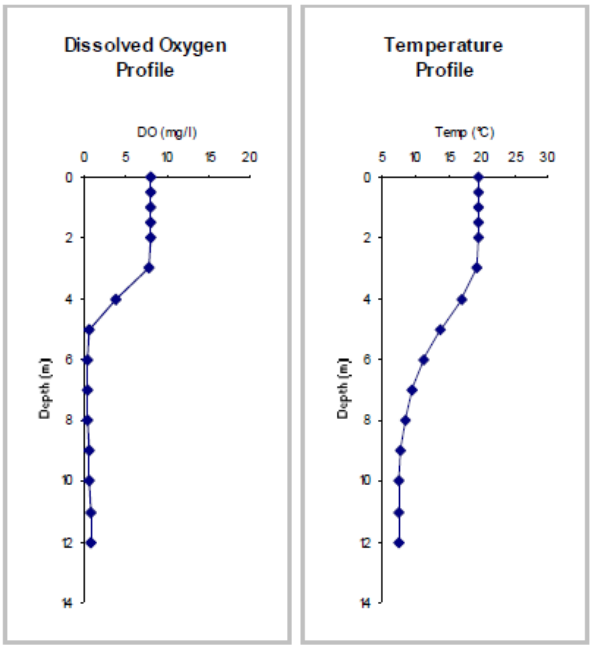
None present.

Figure 35 Dissolved oxygen and temperature profile for Nayre Lough (29/07/2014)

Dissolved Oxygen Profile

GPS Location	H3974733844
Maximum Depth (m)	12.4 m
Secchi Depth (cm)	325 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.07	19.6
0.5	8.09	19.6
1	7.9	19.6
1.5	8	19.5
2	8	19.5
3	7.78	19.3
4	3.8	17
5	0.65	13.7
6	0.43	11.2
7	0.46	9.5
8	0.49	8.4
9	0.53	7.7
10	0.54	7.4
11	0.7	7.4
12	0.75	7.4



Summary

Nayre Lough is a moderate example of a mesotrophic lake, with some characteristic flora and water chemistry. The current survey recorded 4 characteristic species which were present in 39% of all sample plots. There is little change in the macrophyte flora compared to the NILS 1988 survey. The dominant land cover is coniferous plantations and rough pasture. TP levels were within CSM guideline levels (JNCC 2015) and both filamentous algal cover and chlorophyll a levels were low. Despite the lough showing some characteristic features of a mesotrophic lake, the number of characteristic species is lower than the target level set in the CSM guidance (JNCC 2015) but the lough has gained two characteristic species, *P. praelongus* and *B. ranunculoides* since the NILS survey. Given the low number of characteristic species, Nayre Lough is classed as being in an **Unfavourable** condition.

Table 154 Nayre Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Nayre Lough NI Lake 937	**Unfavourable**	Less tha the target number of characteristic species for a mesotrophic lake. *E. canadensis* present	Water chemistry favourable and a moderate diversity of macrophyte taxa present.

Species list

Table 155 List of all plant species recorded at Nayre Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Alisma plantago-aquatica	R
Alnus glutinosa	O
Angelica sylvestris	R
Carex demissa	R
Carex nigra	R
Carex rostrata	O
Eleocharis palustris	R
Equisetum fluviatile	R
Filipendula ulmaria	R
Galium palustre	R
Hydrocotyle vulgaris	R
Iris pseudacorus	R
Juncus acutiflorus	R
Juncus bulbosus	R
Juncus effusus	R
Mentha aquatica	R
Menyanthes trifoliata	R
Phragmites australis	O
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	R
Schoenoplectus lacustris	R
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 62)**
Baldellia ranunculoides	2
Chara virgata	36
Elodea canadensis	21
Fontinalis antipyretica	7
Juncus bulbosus	+
Lemna minor	2
Littorella uniflora	5
Mosses aquatic	2
Myriophyllum alterniflorum	65
Nitella flexilis	2
Nuphar lutea	8
Potamogeton berchtoldii	5
Potamogeton natans	8
Potamogeton obtusifolius	18
Potamogeton perfoliatus	27
Potamogeton praelongus	16

Survey data

Site Condition Assessment: Nayre Lough (29/07/2014)

Lake Details		**Survey Details**		
Lake Name	Nayre Lough	Survey Date	29/07/2014	
SSSI Name		Surveyors	SD & EW	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H398338	Wader Surveys	2	2
WBID / NI No.	50174 / 937	Boat Surveys	2	sections

Site Notes:
Fishing platforms

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	310 cm
		Compass bearing of boat transect (°)	324 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes: Many small perch. Little pike	
Section	**2**	Maximum depth of colonisation (cm)	290 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: J.b growing around fishing platforms.	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H3959333826	H3960633919	H3959433875	H3962733870
Section	**2**	H3997233850	H3991239764	H3994833806	H3989133821

Section Photos

		Start of Section			Whole Section	End of Section
Section	**1**	0088			0089	0090
Section	**2**	0091	0092	0094		

3.30. Mill Lough 966 (MA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	30 July 2014
NI Lake Number:	966
WBID:	50083
County:	Fermanagh
Grid reference:	H467312
OS Grid reference (X,Y):	246685,331247
Shoreline development index:	1.368
Surface area (ha.):	19.1
Maximum recorded depth (m):	12.2

Table 156 Condition Assessment Summary Table for Mill Lough.

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed	X	2 present: *Littorella uniflora* & *Sparganium angustifolium*
	Mesotrophic: ≥ 8 characteristic species listed	X	Only 2 broadleaf *Potamogeton* spp. (*P. alpinus* & *P. perfoliatus*) and 3 other spp.: *L. uniflora, Nitella mucronata.* & *S. angustifolium*
	No loss of characteristic species	✓	No loss in characteristic species since 1989 (NILS)

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	14% of vegetated sample spots comply for mesotrophic species. (20% wader survey & 0% boat survey).
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at very low frequency (4.6%). One zebra mussel observed.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	Only 7.3% of sampling points have a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Rough pasture surrounds lough. Narrow margin of emergent vegetation around the lough (*E. fluviatile, P. arundinacea, T. latifolia, C. rostrata* & *E. palustris). P. amphibia* frequent S1-4 (25- >75 cm) with interspersed *N. lutea* into open water (25-100 cm). *P. natans* occasional S1 & S3 (25-50 cm); *P. obtusifolius* low frequency S2 & S4 (50- >75) and *P. alpinus* forming small local beds S1-3 (25-50 cm). *C. virgata* also forming localised beds in S2 & S4 (25-75 cm), occasionally with *N. mucronata* in S4 (75 cm). *S. angustifolium* only in S3 (25-75 cm) and *F. antipyretica* rare in S3 & S4 (25-75 cm). *E. canadensis* at very low frequency S1-3 in shallow depths (25-50). *L. uniflora* & *P. perfoliatus* observed on strandline of S2. No zonation of *Littorelletea* spp. and vegetation growth restricted to shallow depths ≤ 100 cm.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 12.2 m, Z_s = 0.98 m, Z_v = 1.0 m.
	At least the present structure should be maintained	**?**	Previous data insufficient for comparison.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 15 μgl^{-1}	**X**	TP = 42 μgl^{-1} (range 31-53) & TN = 1.10 mgl^{-1} (April '14 – Feb. '15). Unfavourable for both oligotrophic and mesotrophic
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.5 (range = 7.4 – 7.6).

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 7 mlg^{-1} below thermocline)	X	Waters well oxygenated between 0 – 3.5 m (DO > 12 mgl^{-1}) but mean value below thermocline = 0.24 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	None noted
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	X	Shoreline on north shore has been modified – concrete footpath, gravel shoreline. Numerous jetties all around lough.
	Natural and characteristic substrate maintained	✓	Predominantly silty substrates in the open water. A mixture of gravel and silt within the shallow depths, 25 - >75 cm depth.
Sediment load	Natural sediment load maintained	✓	Some grazing observed, but minimal poaching.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓?	Extent of grazing unknown and minimal poaching observed. Jetties for shore angling all around lough.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 19.1 ha with no loss of extent to the open water.

Macrophyte community composition

Mill Lough lies within a catchment of rough pasture and improved grazing, underlain by a superficial layer of alluvial materials and glacial till. Zonation of *Littorelletea* species was virtually absent – *Littorella uniflora* was observed on the strandline and *Sparganium angustifolium* was recorded only on the southwest shore of the lough. Other characteristic species typical of mesotrophic standing waters were *Nitella mucronata* and only two broadleaved *Potamogeton* species were recorded: *P. alpinus* and *P. perfoliatus.* Mill Lough does not pass either the oligotrophic or mesotrophic compositional targets, nor does it meet the species frequency targets of >60% of sample plots having one or more characteristic species for mesotrophic or oligotrophic standing waters. Non-characteristic submerged and floating-leaved species include *Chara virgata, Elodea canadensis, Fontinalis antipyretica, Nuphar lutea, Persicaria amphibia, Potamogeton natans* and *Potamogeton obtusifolius.* The marginal emergent vegetation comprises of *Equisetum fluviatile, Phalaris arundinacea, Typha latifolia, Carex rostrata* and *Eleocharis palustris.*

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan et al. 2006) of the site were 6.9 and 6.13 respectively (Table 157). The PLEX score calculated from the 1989 survey data was significantly lower than that from 2014,

although this could be a reflection of the higher number of plant species which were recorded in the 2014 survey, compared to the four species documented in 1989. The only species which was recorded in 1989 but not in 2014 was *Sparganium emersum*, which was identified as *Sparganium angustifolium* within the recent survey. *Littorella uniflora* was recorded as 'frequent' (3 on a scale of 1-5) in 1989, while it was only found on the strandline in 2014. Conversely, *Nuphar lutea* was only recorded with an abundance of '2' in 1989, yet in 2014 the frequency had increased to 68% and classed as 'frequent ('3'). Survey methods were also very different in 1989 to those employed in 2014, which could also explain the varying species lists. A full species list is given in Table 160.

Table 157 Aquatic macrophyte community composition for Mill Lough, including trophic scores

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=110)***
Chara virgata	-	-	-	8.5	7.69	5
Elodea canadensis	-	-	-	8.5	7.95	5
Fontinalis antipyretica	6.3	5.38	2	6.3	5.38	2
Littorella uniflora	**6.7**	**4.23**	**3**	**6.7**	**4.23**	**+**
Nitella mucronata	**-**	**-**	**-**	**5.5**	**5.38**	**2**
Nuphar lutea	8.5	6.92	2	8.5	6.92	68
Persicaria amphibia	-	-	-	9.0	7.95	43
Potamogeton alpinus	**-**	**-**	**-**	**5.5**	**5.38**	**10**
Potamogeton natans	-	-	-	6.7	4.23	5
Potamogeton obtusifolius	-	-	-	7.3	6.54	26
Potamogeton perfoliatus	**-**	**-**	**-**	**7.3**	**7.69**	**+**
Sparganium angustifolium	**-**	**-**	**-**	**3.0**	**4.23**	**2**
Sparganium emersum	10.0	7.50	1	-	-	**-**
Average score	**7.9**	**6.01**		**6.9**	**6.13**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species not recorded in the wader and boat surveys, but notes as present in the site.

Negative indicator species

Elodea canadensis was recorded at a very low frequency of 4.6%. One zebra mussel was observed during the survey.

Macrophyte community structure

Rough pasture and improved grazing surrounds the lough to all sides. A narrow margin of vegetation borders the lough, which consists of *Equisetum fluviatile, P. arundinacea, T. latifolia, C. rostrata and Eleocharis palustris. Persicaria amphibia* frequents the shallow waters from 25 - >75 cm in all sections, which is interspersed by *Nuphar lutea* into the open water (25 – 100 cm). Other floating leaved and

submerged aquatic vegetation include *Potamogeton natans,* which was occasionally seen within the north and southern regions of the lough, in shallow depths of 25 – 50 cm. *Potamogeton obtusifolius* appeared in low frequencies in S2 and S4 between 50 - >75 cm, while *Potamogeton alpinus* was found forming small localised beds in S1-3 in shallow depths of 25-50 cm. *Chara virgata* was recorded in S2 and S4 at similar depths, forming localised beds, intermingled by the occasional *Nitella mucronata* in S4 at 75 cm depth. *Sparganium angustifolium* was only recorded in S3 (south-western side) in low abundance between 25 – 75 cm while *Fontinalis antipyretica* was of equally low frequency in S3 and S4 at similar depths. *Elodea canadensis,* although not recorded in 1989, was recorded in 2014 at a very low frequency of 5% in S1-3, in shallow depths of 25 – 50 cm. Two characteristic species, *Littorella uniflora* and *Potamogeton perfoliatus*, were found only on the strandline and not within the confines of the survey. Apart from *S. angustifolium,* no other *Littorelletea* species were recorded and so there was very little zonation of characteristic species typical of oligotrophic-mesotrophic standing waters. In general, aquatic vegetation was restricted to shallow water depths of up to 100 cm. The current structure is considered to be unfavourable for a site of this type.

Water quality

Table 158 Water chemistry data for Mill Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1989
TP	33.5	31.9	49.8	53.5	**42.2**	24
SRP	9.0	3.0	19.3	31.5	**15.6**	3
TN	0.98	0.96	1.20	1.27	**1.10**	1.19
TON	0.294	0.076	0.322	0.301	**0.248**	-
Nitrite	0.006	0.002	0.008	0.004	**0.005**	-
Chl *a*	7.04	4.95	2.09	0.22	**3.58**	14.87
DOC	12.00	17.40	15.60	15.20	**15.05**	-
pH	7.54	7.60	7.43	7.45	**7.50**	8.16
Alk	40	49	50	31.	**43**	27.9
Cond	116	124	131	117	**122**	168
Ca^{2+}	16.00	18.40	19.90	15.30	**17.40**	19
Mg^{2+}	1.64	1.82	1.89	1.65	**1.75**	1.8
Na^{+}	6.34	5.94	6.34	7.18	**6.45**	3.2
K^{+}	1.38	1.46	1.74	1.70	**1.57**	0.2
Cl^{-}	12.80	10.40	11.70	15.70	**12.65**	12.8
SO_4^{2-}	<10	5.97	7.27	6.27	**7.38**	4.9

The water chemistry at Mill Lough is fairly typical for a low to moderate alkalinity mesotrophic lough, having a circumneutral pH and slightly elevated ionic concentration. The water colour in the lough was a dark peaty brown and so light penetration only reached 0.98 m in depth. The mean annual concentration for total phosphorus is above the target level set in the CSM guidelines for both the oligotrophic and mesotrophic lake types (10 and 15 $\mu g l^{-1}$ respectively, JNCC 2015), however it is recognised that the interaction of nutrients in peaty sites is complex and

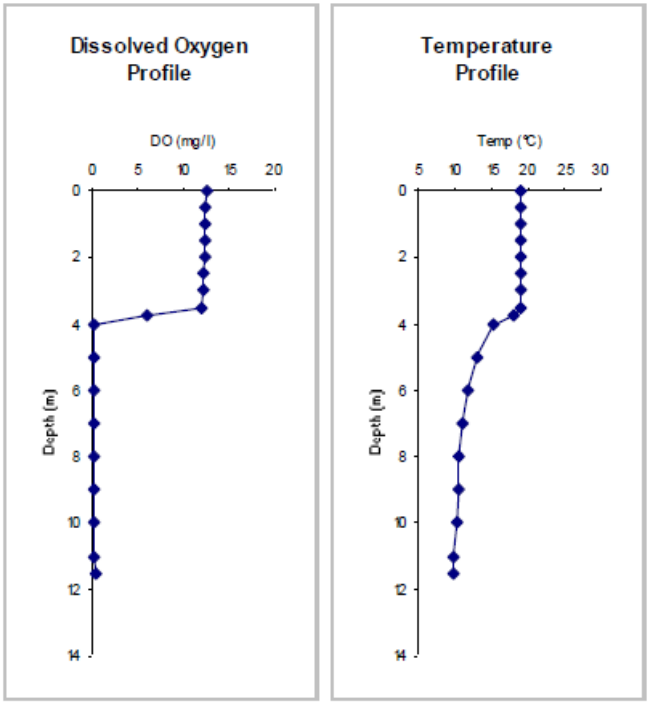
therefore elevated TP is not always indicative of unfavourable conditions. The lower total nitrogen values in the spring/summer months suggest that the site may be limited by the availability of nitrogen rather than phosphorus. Low levels of filamentous algae were recorded, and the site shows no indications of nutrient enrichment. Chl *a* concentration was on average low throughout the year and appears to have decreased since it was measured in 1989. However, direct comparisons between the 1989 and 2014 data must be treated with caution as the surveys were conducted using very different methods. The lake was fairly well oxygenated within the photic zone at the time of survey in July 2014 (DO > 12 mgl^{-1} from 0 – 3.5 m water depth) but below the thermocline the mean value only equalled 0.24 mgl^{-1}. Under the CSM guidelines (JNCC 2015), this is considered to be unfavourable for a stratified lake.

Figure 36 Dissolved oxygen and temperature profile for Mill Lough (30/07/2014)

Dissolved Oxygen Profile

GPS Location	H4684731253
Maximum Depth (m)	12.2 m
Secchi Depth (cm)	98 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	12.68	19.1
0.5	12.35	19.1
1	12.47	19.1
1.5	12.3	19.1
2	12.32	19.1
2.5	12.27	19.1
3	12.19	19.1
3.5	12.06	19
3.75	6	18
4	0.2	15.3
5	0.2	12.9
6	0.21	11.7
7	0.21	11.1
8	0.23	10.6
9	0.23	10.4
10	0.25	10.2
11	0.27	9.7
11.5	0.3	9.7



Hydrology

Mill Lough has an inflow to the north and drains to the west. The source to the outflow stream originates in Tully Forest where shallow peats underlie coniferous forest. The outflow passes through a number of small loughs to the west, until it eventually drains into Upper Lough Erne. The hydrological regime appears natural.

Lake substrate

The lake marginal substrates comprise of a mixture of gravel and silt, with root mass dominating the shallowest waters. Small areas of sandy substrate prevail along the north shore of the lough. The open water substrates are silty.

Sediment load

The lough is surrounded by rough pasture and improved grazing. Although some grazing was observed during the survey, no poaching was observed at the lake edge. There was no direct or indirect evidence of increased sediment loads.

Indicators of local distinctiveness

No indicators of local distinctiveness were recorded within the 1989 or 2014 surveys.

Summary

Mill Lough is classified as an "oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*", but fails to achieve the necessary floristic requirement as defined within the CSM guidance (JNCC 2015) for either oligotrophic or mesotrophic species. Comparison of the 1989 and 2014 survey species data is limited given that only four species were recorded back then. However, the 1989 data does indicate that *Littorella uniflora* was frequent at least 25 years ago, and has now only been found on the strandline at low frequency. *Littorelletea* zonation was not evident given the limited associated flora, and aquatic plants were restricted to depths of up to 100 cm. The water chemistry data to some extent suggests favourable condition, although the seasonal TP concentrations exceeded the upper limit for favourable condition in mesotrophic loughs. Further monitoring is recommended to fully establish the condition of the lough and to determine whether fishing activities have altered the water chemistry and consequently the trophic status and plant communities. The current survey places the lough in **unfavourable** condition**.**

Table 159 Mill Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Mill Lough NI Lake 966	**Unfavourable**	Fails to achieve the floristic requirements for this lake type. Lack of *Littorelletea* species and zonation. Seasonal TP values exceed the upper limit for mesotrophic loughs.	Water chemistry to some extent suggests favourable condition. Further monitoring is recommended to establish whether frequent fishing activities have impacted upon lake trophic status.

Species list

Table 160 List of all plant species recorded at Mill Lough: 2014

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Alnus glutinosa	O
Angelica sylvestris	R
Caltha palustris	R
Carex rostrata	O
Eleocharis palustris	R
Epilobium hirsutum	R
Filipendula ulmaria	R
Hydrocotyle vulgaris	R
Hypericum tetrapterum	R
Juncus acutiflorus	R
Juncus effusus	R
Lythrum salicaria	R
Mentha aquatica	R
Myosotis scorpioides	R
Phalaris arundinacea	O
Phragmites australis	R
Ranunculus flammula	R
Salix sp.	O
Senecio aquaticus	R
Sparganium erectum	R
Stachys palustris	R
Stachys sylvatica	R
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 110)**
Chara virgata	5
Elodea canadensis	5
Fontinalis antipyretica	2
Littorella uniflora	+
Nitella mucronata	2
Nuphar lutea	68
Persicaria amphibia	43
Potamogeton alpinus	10
Potamogeton natans	5
Potamogeton obtusifolius	26
Potamogeton perfoliatus	+
Sparganium angustifolium	2

Survey data

Site Condition Assessment: Mill Lough (30/07/2014)

Lake Details		**Survey Details**		
Lake Name	Mill Lough	Survey Date	30/07/2014	
SSSI Name		Surveyors	SG, EF	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	H467312	Wader Surveys	4	4
WBID / NI No.	50083 / 966	Boat Surveys	4	sections

Site
Zebra mussel x1 present at site

Survey

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	60 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	20 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	95 cm
		Compass bearing of boat transect (°)	90 °
		Lateral distance from waters edge to 75cm depth (m)	20 m
		Notes:	
Section	**3**	Maximum depth of colonisation (cm)	75 cm
		Compass bearing of boat transect (°)	150 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**4**	Maximum depth of colonisation (cm)	100 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	-
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H4679531434	H4689131457	H4683931453	H4684731391
Section	**2**	H4690431073	H4682231021	H4686731046	H4685131071
Section	**3**	H4653531187	H4645631129	H4648931166	H4648631170
Section	**4**	H4641231361	H4651131408	H4646631396	H4646931371

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	127-0312	127-0313	127-0314
Section	**2**	127-0315	127-0316	127-0317
Section	**3**	127-0320	127-0319	127-0318
Section	**4**	0103	0102	0101

3.31. Crossbane Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*.

Survey Date	18 June 2015
NI Lake Number:	1151
WBID:	50458
County:	Armagh
Grid reference:	H809299
OS Grid reference (X,Y):	280861,329897
Shoreline development index:	1.301
Surface area (ha.):	2.10
Maximum recorded depth (m):	3.0

Table 161 Condition Assessment Summary Table for Crossbane Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	None
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic Littorelletea species (≥ 2 if valid reasons suggest otherwise)	✓	4 present: *Apium inundatum*, *Littorella uniflora, Sparganium angustifolium* & *Utricularia vulgaris* agg.
	Mesotrophic: ≥ 3 Characteristic *Potamogeton* spp. and ≥ 8 others characteristic species	**X**	1 characteristic broadleaf *Potamogeton* spp.: *P. alpinus* and only 3 other characteristic spp.: as above, but not *A. inundatum.*.

Attribute	Target	Status	Comment
	No loss of characteristic species	✓	No losses, but significant reduction in *L. uniflora* since 1989 (NILS).
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	Only 25% of vegetated sample spots comply for oligo-mesotrophic spp.
Negative indicator species	Non-native species absent or present at low frequency	**X?**	*Elodea canadensis* at 11% frequency. Possibly declined since 1989.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	No filamentous algae recorded above '1' – median = 0.
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Margins with species rich wetland flora dominated by *Carex rostrata, Menyanthes trifoliata* *Potentilla palustris, Equisetum fluviatile* and *Carex rostrata.* Site shallow throughout and with brown water. Open water flora dominated by *N. lutea* to max of 155 cm. Littoral zone with emergent *E. fluviatile* & *C. rostrata* with *L. uniflora* (rare, S1 only), *F. antipyretica, E. canadensis* & *U. vulgaris* agg. all frequent. *N. lutea* & *P. natans* were also common beyond the margin. A single record only for *A. inundatum.* Being very shallow and with characteristic species, rare, there was no characteristic zonation.
	Maximum depth distribution should be maintained	**X?**	Z_{max} = 3.00 m, Z_s = > 0.70 m, Z_v = 1.55 m. Plant depth restricted by brown water, but water also turbid
	At least the present structure should be maintained	**X?**	NILS data (1990) suggests *L. uniflora* & *P. alpinus* to have been more frequent.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 20 μgl^{-1}	**X**	TP = 45 μgl^{-1} (range 39 - 55) & TN = 1.5 mgl^{-1} (Nov'14 – Apr'15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓**?**	pH = 7.38 (range = 7.3-7.5). Stable, albeit just above 7.0.
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	Water well oxygenated and mixed. Mean DO > 7.2 mgl^{-1}

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	X	Water turbid and Chl a values high throughout sampling period (mean 28 μgl^{-1} Nov'14 – Apr'15).
Hydrology	Natural hydrological regime	✓?	Unknown. Possibly some historical drainage of wetlands.
Lake substrate	Natural shoreline maintained	✓?	No recent change. Some disturbance at west end near farm buildings
	Natural and characteristic substrate maintained	✓	Predominantly organic / peat margins with occasional boulders. Silts in open water.
Sediment load	Natural sediment load maintained	✓	No evidence of increased siltation.
Indicators of local distinctiveness	Distinctive elements maintained	-	None noted.
	Minimal negative impacts and no fish farming	✓?	Improved pasture around site and poorly kept farm building close to lough shore.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The current extent of the lake appears stable, but the site is shallow and encroachment of the wetland fringe is likely to be exacerbated by high nutrients.

Macrophyte community composition

The site has an extensive wetland flora for which it was originally designated as an ASSI; the majority of the wetland were not surveyed within this project. At the lough margin, Common species included: *Carex rostrata, Equisetum fluviatile, Menyanthes trifoliata, Potentilla palustris, Juncus articulatus* and *Carex nigra.* The wetland areas were particularly species rich in some areas (see Table 165) and included notable species such as Lesser butterfly-orchid (*Platanthera bifolia*), which although not rare in Northern Ireland is more commonly associated with calcareous sites.

The flora is not typical of oligotrophic waters, and although it does support four characteristic oligotrophic species, it falls well short of the overall floristic requirements for mesotrophic loughs. *Littorella uniflora* was rare in the site and found only in very shallow water whereas it was recorded as abundant in 1989 (NILS). *Utricularia vulgaris* agg. was the only common characteristic species recorded and overall, less than half the survey points had any characteristic species present.

More generally, although relatively species rich (see Table 172) the flora was more typical of eutrophic waters and included *Fontinalis antipyretica, Elodea canadensis, Lemna trisulca, Nuphar lutea, Potamogeton natans* and *P. obtusifolius.* Given the mixed geology of the area and predominance of lowland agriculture to the west and north of the site, the lough is best classified as being towards the mesotrophic end of the Annex 1, H3130 type. The basin is shallow, only 3.0 m at the deepest point, and while it might not therefore be expected to support a full array of mesotrophic species as listed in the CSM guidance (JNCC 2015), it nonetheless shows signs of an impoverished flora. The abundance of *L. uniflora, S. angustifolium* and *P. alpinus*

all appear to have decreased significantly since 1989 (NILS) and is of particular concern. *Elodea canadensis* is possibly less abundant than in 1989, but is well established in the site. The flora was unfavourable in 1989, and remains so in 2015.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 6.9 and 6.10 respectively which remains very slightly higher than the 1989 scores (Table 172), but both are indicative of enrichment.

Table 162 Aquatic macrophyte community composition for Crossbane Lough, including trophic scores

	1989 (NILS)			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=53)***
Apium inundatum	**7.0**	**7.50**	**1**	**7.0**	**7.50**	**+**
Callitriche sp.	-	-	2			+
Callitriche hamulata	5.0	6.15	2			-
Elodea canadensis	8.5	7.95	3	8.5	7.95	11
Fontinalis antipyretica	6.3	5.38	1	6.3	5.38	25
Juncus bulbosus	3.7	3.08	2			-
Lemna minor	9.0	8.85	1			-
Lemna trisulca	10.0	8.85	1	10.0	8.85	2
Littorella uniflora	**6.7**	**4.23**	**4**	**6.7**	**4.23**	**4**
Liverworts aquatic			-	-	-	4
Myriophyllum alterniflorum	5.5	4.23	3	5.5	4.23	2
Nuphar lutea	8.5	6.92	3	8.5	6.92	32
Persicaria amphibia			-	9.0	7.95	+
Potamogeton alpinus	**5.5**	**5.38**	**2**	**5.5**	**5.38**	**+**
Potamogeton berchtoldii			-	7.3	7.69	+
Potamogeton natans	6.7	4.23	3	6.7	4.23	8
Potamogeton obtusifolius				7.3	6.54	+
Sparganium angustifolium	**3.0**	**4.23**	**3**	**3.0**	**4.23**	**+**
***Utricularia vulgaris* agg.**			**-**	**5.5**	**4.23**	**25**
Average score	**6.6**	**5.92**		**6.9**	**6.10**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis has been a component of the flora since before 1989, and its current abundance is probably slightly less than the levels recorded in 1990 (recorded as "3" on a 1-5 scale). Its presence at the site along with area of dense *F. antipyretica* cover, occupies some of the available habitat that would normally be expected to support an Isoetid flora. The presence of these species at high abundance is therefore unfavourable. Despite relatively high nutrients filamentous algae cover was low.

Macrophyte community structure

The extensive marginal wetlands represent a varied array of habitats grading from emergent species at the lough edge through mixed fen, acid grassland, scrub and old peat cuttings. To the south of the site, the wetlands give way to acid heath,

whereas to the north and west, there id semi-improved and improved pasture. The wetland habitats require assessment in their own right and were not surveyed as part of this project.

Within the open water, the littoral zone is characterised by an emergent flora with *E. fluviatile* & *C. rostrata* dominating and *M. trifoliata* locally abundant. *Littorella uniflora* was rare, and only recorded at 2 points in section 1. *Fontinalis antipyretica, E. canadensis* and *U. vulgaris* agg. were more frequent in the shallow margins and in places formed dense cover. *Nuphar lutea* and *P. natans* were also common in the littoral zone and beyond into slightly deeper water where *N. lutea* was recorded at a maximum depth of 1.55 m. A number of species were recorded only within the strandline and are assumed therefore to be rare within the site (Table 172). Being very shallow and with an impoverished flora, there was no characteristic zonation.

Water quality

Table 163 Water chemistry data for Crossbane Lough

	Nov '14	Feb'15	Apr'15	Mean	1989
TP	54.9	40.8	38.6	**44.8**	33.0
SRP	15.8	18.5	4.2	**12.8**	3.0
TN	1.440	1.670	1.320	**1.477**	0.86
TON	0.376	0.718	0.202	**0.432**	0.01
Nitrite	0.003	0.007	0.002	**0.004**	-
Chl *a*	31.6	28.5	24.0	**28.0**	18.3
DOC	16.0	17.7	14.4	**16.0**	-
pH	7.30	7.37	7.49	**7.38**	7.46
Alk	46	41	46	**44**	37
Cond	142	135	135	**137**	110
Ca^{2+}	17.2	15.9	16.3	**16.5**	15.0
Mg^{2+}	3.5	3.2	3.2	**3.3**	2.3
Na^{+}	7.3	7.0	7.3	**7.2**	3.0
K^{+}	3.4	3.4	3.0	**3.3**	-
Cl^{-}	13.9	13.4	14.7	**14.0**	10.5
SO_4^{2-}	9.5	10.4	9.5	**9.8**	8.0

The water chemistry of Crossbane Lough is typical for a medium alkalinity mesotrophic lough, with circumneutral pH and slightly elevated ionic concentration. Total phosphorus is however above the target level set in the CSM guidelines for shallow mesotrophic loughs (20 μgl^{-1} JNCC 2015). Although the current data is missing a summer value, the mean of 3 quarterly samples was 44.8 μgl^{-1} which exceeds the value recorded from the site in 1989 (33 μgl^{-1}). In addition to the high TP, TN was also high and exceeded the CSM guidance in February 2015. Chl *a* concentrations were high on all visits to the site and the water was visibly turbid (as well as being brown) during the survey in June 2015. The site has clearly suffered from eutrophication and being so shallow, it probably has less resilience to

enrichment than deeper loughs. The current trophic status is unfavourable and recovery of the site would require investigation and reduction of external nutrients sources to the site.

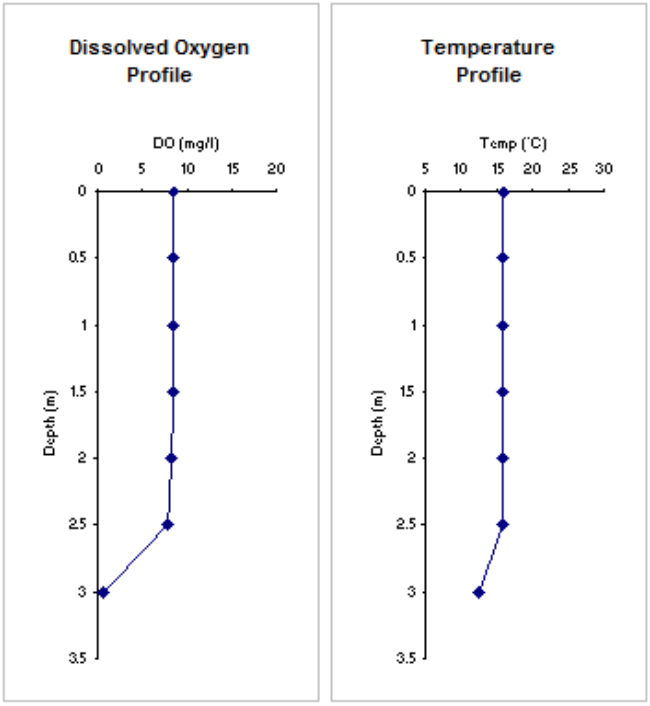
Dissolved oxygen concentrations were good at the time of sampling. (Figure 39).

Figure 37 Dissolved oxygen and temperature profile for Crossbane Lough (18/06/2015)

Dissolved Oxygen Profile

GPS Location	H8088429877
Maximum Depth (m)	3 m
Secchi Depth (cm)	70 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.52	15.8
0.5	8.48	15.8
1	8.4	15.8
1.5	8.38	15.8
2	8.32	15.8
2.5	7.78	15.7
3	0.66	12.5



Hydrology

The hydrological regime at the site appears to be under natural control, although the outflow does appear to have been deepened at some point. No further drainage work should be permitted without a thorough assessment of the impact.

Lake substrate

The lake margins are predominantly organic silts and peat made up from the surrounding fen vegetation. There are some areas of rocky shore with boulders. The majority of the open water has fine silty substrates.

Sediment load

There was no evidence of increased sediment loads from external sources, but eutrophication will increase internal productivity and potentially cause higher sedimentation rates and fen encroachment. This should be monitored to prevent any loss of open water habitat.

Indicators of local distinctiveness

The site was designated as an ASSI on the basis of the quality of the fen and wetland habitats rather than open water features. Within open water, the decline of

Littorella uniflora and potentially other characteristic species is of concern, and compromises the distinctive elements of this site.

Summary

Crossbane Lough is classified as an "oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*". The site is shallow and although buffered around some of its shore by areas of extensive wetland, it mainly lies within an area of semi-improved lowland pasture and is not therefore typical of this standing water type. As such it is unlikely that the lough would have ever supported a characteristic mesotrophic flora of the type defined within the CSM guidance (JNCC 2015). Nonetheless, a favourable assemblage would still be expected to have much greater abundance of *L. uniflora* as well as a number of other mesotrophic species that were not recorded in the current survey. Eutrophication is most likely cause for the poor floristic quality.

Water quality was poor at the site and in addition to high TP and TN, the pH was also above that expected for mesotrophic loughs (JNCC 2015). TP concentrations were also above target values in 1990 which suggests nutrient pollution is on-going at the site. The current water quality and aquatic macrophyte flora are more indicative of degraded eutrophic conditions and therefore the lough is classified as **unfavourable** for its designated type. Management of the open water should focus on identifying and reducing any nutrient inputs to the lough. The CSM guidance for mesotrophic lakes is focused more towards larger and deeper lakes and therefore the condition targets used here may be unrealistic for this small shallow site. Sites like this would be better assessed against site specific restoration targets based on palaeoecological studies that can determine the historical plants assemblages and potentially also the timing and cause of its decline.

Table 164 Crossbane Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Crossbane Lough NI Lake 1151	**Unfavourable**	High TP and TN Low number and cover of characteristic species. Significant reduction in *L. uniflora* *Elodea canadensis* present (established)	Crossbane Lough maintains an interesting marginal wetland flora, but the open water is eutrophic and dominated by non-characteristic species with evidence of species decline.. Site specific floristic targets should be defined and management should focus on identifying and reducing nutrient inputs.

Species list

Table 165 List of all plant species recorded at Crossbane Lough

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Angelica sylvestris	R
Caltha palustris	R
Cardamine pratensis	R
Carex curta	R
Carex echinata	R
Carex limosa	R
Carex nigra	O
Carex panicea	R
Carex rostrata	A
Carex viridula subsp. oedocarpa	R
Drosera rotundifolia	R
Eleocharis palustris	R
Equisetum fluviatile	A
Equisetum palustre	R
Eriophorum angustifolium	R
Filipendula ulmaria	R
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus articulatus	O
Juncus effusus	R
Liverworts unid	R
Lotus pedunculatus	R
Luzula multiflora	R
Menyanthes trifoliata	F
Myosotis laxa	R
Narthecium ossifragum	R
Pedicularis palustris	R
Platanthera bifolia	R
Potentilla palustris	F
Ranunculus flammula	R
Rorippa nasturtium-aquaticum	R
Salix sp.	F
Senecio aquaticus	R
Sparganium erectum	R
Sphagnum sp.	R
Veronica beccabunga	R

Submerged & floating species	% Frequency (n = 53)
Apium inundatum	**+**
Callitriche sp.	+
Elodea canadensis	11
Fontinalis antipyretica	25
Lemna trisulca	2
Littorella uniflora	**4**
Liverworts aquatic	4
Myriophyllum alterniflorum	2
Nuphar lutea	32
Persicaria amphibia	+
Potamogeton alpinus	**+**
Potamogeton berchtoldii	+
Potamogeton natans	8
Potamogeton obtusifolius	+
Sparganium angustifolium	**+**
***Utricularia vulgaris* agg.**	**25**

Survey data

Site Condition Assessment: Crossbane Lough (18/06/2015)

Lake Details		**Survey Details**		
Lake Name	Crossbane Lough	Survey Date	18/06/2015	
SSSI Name		Surveyors	ES & JS	
SAC Name		Shore Surveys	2	out of
Grid Ref	H809299	Wader Surveys	2	2
WBID / NI No.	50458 / 1151	Boat Surveys	2	sections

Site Notes:

possibly herbicides??

Survey Notes:
Vegetation around outflow (Nr house) browed -

Rest of site ok.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	155 cm
		Compass bearing of boat transect (°)	80 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes: Lots of Assellus & Gammarus	
Section	**2**	Maximum depth of colonisation (cm)	140 cm
		Compass bearing of boat transect (°)	270 °
		Lateral distance from waters edge to 75cm depth (m)	12 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H8100229923	H8095229865	H8097429882	H8095629879
Section	**2**	H8076229889	H8075229960	H807522992	H8077429915

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	4011	4001	4010
Section	**2**	4013	4014	4018

3.32. Drumlougher Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	21 June 2015
NI Lake Number:	1175
WBID:	50360
County:	Armagh
Grid reference:	H894187
OS Grid reference (X,Y):	289439,318657
Shoreline development index:	1.117
Surface area (ha.):	3.2
Maximum recorded depth (m):	9.5

Table 166 Condition Assessment Summary Table for Drumlougher Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	

Attribute	Target	Status	Comment
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓	4 present: *Littorella uniflora, Sparganium angustifolium, Eleogiton fluitans* & *Utricularia vulgaris agg.*
	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	**X**	Only one characteristic broadleaf *Potamogeton* sp.: *P. alpinus* and 3 other characteristic spp.*:* as above.
	No loss of characteristic species	**✓?**	No loss of characteristic species, but decline in abundance of *L. uniflora*
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	Only 10% of vegetated sample spots comply for oligotrophic spp. and 19% for mesotrophic spp.
Negative indicator species	Non-native species absent or present at low frequency	✓	Non recorded
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	No filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Some good wetland margins around most of the lough with *Carex rostrata, Equisetum fluviatile, Eleocharis palustris, Menyanthes trifoliata, Potentilla palustris* & *Juncus* spp. common. *Osmunda regalis* also recorded. The shallow littoral mainly comprised of emergent species (as above) with *L. uniflora* rare to 50 cm and *P. alpinus, U. vulgaris agg.* & *E. fluitans* also rare. In deeper water, *N. lutea* was common to 1.7 m & *P. natans* occasional to 2.5 m. *S. angustifolium* was recorded in S1 only to 1.4 m. The characteristic flora was sparse and therefore characteristic zonation was not present.
	Maximum depth distribution should be maintained	**✓?**	Z_{max} = 9.5 m, Z_s = > 1.15 m, Z_v = 2.5 m.
	At least the present structure should be maintained	**X?**	NILS data (1990) suggests *L. uniflora* to be more abundant in the site.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 20 μgl^{-1}	**X**	TP = 45 μgl^{-1} (range 39 - 55) & TN = 1.5 mgl^{-1} (Nov'14 – Apr'15).

Attribute	Target	Status	Comment
	Stable pH values: pH ~ 5.5 – circumneutral	✓?	pH = 7.38 (range = 7.3-7.5). pH higher than expected.
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	X?	Well oxygenated in surface water, but falling to a mean of 1.96 mgl^{-1} below the thermocline.
	No excessive growth of cyanobacteria or green algae	✓?	No cyanbacterial blooms, but high Chl a values recorded in April '15 (20.6 μgl^{-1}).
Hydrology	Natural hydrological regime	✓?	Unknown. Possibly some historical drainage of wetlands.
Lake substrate	Natural shoreline maintained	✓	No recent change
	Natural and characteristic substrate maintained	✓	Predominantly organic / peat margins with occasional rock and sand. Silts in open water.
Sediment load	Natural sediment load maintained	?	No evidence of increased siltation, but slurry spreading on land draining to lough has potential to increase in wash.
Indicators of local distinctiveness	Distinctive elements maintained	-	Surrounding wetland habitat is of high ecological value.
	Minimal negative impacts and no fish farming	✓?	Improved pasture around north and western margins (including slurry spreading to SW). Impact unknown.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 3.2 ha with no loss of extent to the open water.

Macrophyte community composition

The site has an extensive wetland flora, with particularly good transitional vegetation along the south and west shores. Common species included: *Carex rostrata, C. nigra Equisetum fluviatile, Potentilla palustris, Menyanthes trifoliata, Eleocharis palustris, Juncus* spp. *Galium palustre* and *Filipendula ulmaria.* The wetland area to the south and west of the lough is particularly species rich extensive and is the primary reason for ASSI selection.

There were four characteristic oligotrophic species recorded in the Lough during the 2015 survey: *Littorella uniflora, Sparganium angustifolium, Eleogiton fluitans & Utricularia vulgaris agg.* All were rare in the site with *E. fluitans* only recorded growing terrestrially and a single record for *Utricularia vulgaris* agg. *Potamogeton alpinus,* a characteristic mesotrophic species, was also recorded, but was uncommon in the site. Other species present were *Nuphar lutea, Potamogeton natans, Fontinalis antipyretica, Lemna trisulca* and *Nymphaea alba* (Table 167).

This assemblage is similar in composition to that recorded in 1990 (NILS), but *L. uniflora* was recorded at an abundance of "5" (1-5 scale) in 1990 and was therefore

growing at much higher abundance than in 2015. *Myriophyllum alterniflorum* was also recorded as frequent ("3") in 1990, but was not seen in 2015. One further point is the presence of *Sparganium emersum* in the NILS data, whereas *Sparganium angustifolium* was recorded in 2015. Fruiting material was not present in June 2015, but vegetative material had round stems and narrow (4-6 mm) leaves which were completely flattened to their base and hence most likely to be *S. angustifolium.* Despite having a greater abundance of *L. uniflora* in 1990, the flora would still have been classified as unfavourable under CSM guidelines (JNCC 2015) and remains unfavourable in 2015.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 6.3 and 4.96 respectively which, are lower than the scores (Table 253) as a result of the rarities recorded in 2015 (*E. fluitans* & *U. vulgaris*) and the much lower scores attributed to *S. angustifolium* compared to *S. emersum*.

Table 167 Aquatic macrophyte community composition for Drumlougher Lough, including trophic scores

	1990 (NILS)			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=59)***
Callitriche sp.	-	-	1	-	-	-
Eleogiton fluitans	-	-	-	**4.0**	**3.08**	+
Fontinalis antipyretica	6.3	5.38	2	6.3	5.38	3
Lemna minor	9.0	8.85	2	-	-	-
Lemna trisulca	-	-	-	10.0	8.85	2
Littorella uniflora	**6.7**	**4.23**	**5**	**6.7**	**4.23**	**5**
Myriophyllum alterniflorum	5.5	4.23	3	-	-	-
Nuphar lutea	8.5	6.92	3	8.5	6.92	61
Nymphaea alba	6.7	3.08	2	6.7	3.08	2
Potamogeton alpinus	**5.5**	**5.38**	**1**	**5.5**	**5.38**	**8**
Potamogeton natans	6.7	4.23	3	6.7	4.23	15
Potamogeton obtusifolius	7.3	6.54	1	-	-	-
Sparganium angustifolium	-	-	-	**3.0**	**4.23**	**5**
Sparganium emersum	10.0	7.5	2	-	-	-
***Utricularia vulgaris* agg.**	-	-	-	**5.5**	**4.23**	+
Average score	**7.2**	**5.63**		**6.3**	**4.96**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

There were no negative indicator species recorded and filamentous algae was recorded at only one location at low abundance.

Macrophyte community structure

The marginal wetlands represent good examples of both base-rich and acid fen which grade into semi-natural lowland heath to the east and old peat cuttings to the south. The improved pasture to the southwest and north of the site is relatively well buffered by strips of wetland (less so to the north). The extensive mosaic of wetland types around the lough is the primary reason for designation and known to support a rich invertebrate community.

Within the open water, the characteristic oligo-mesotrophic flora is very limited with only sparse growths of *Littorella uniflora* to 50 cm and occasional beds of *Sparganium angustifolium* to 1.4 m. *Potamogeton alpinus* was recorded at several locations in the lough, but mostly restricted to shallow water (< 50 cm) where it grew within the shelter of emergent vegetation. *Nuphar lutea* formed large beds around the south and west sides with sparse growths elsewhere extending to a maximum depth of 1.9 m. *Potamogeton natans* was more common in the south of the lough but only formed sparse beds to a maximum recorded depth of 2.5 m. Although the wetland flora is relatively good, the characteristic components are missing from open water and the structure is therefore unfavourable.

Water quality

Table 168 Water chemistry data for Drumlougher Lough

	Nov '14	Feb'15	Apr'15	Mean	1990
TP	54.9	40.8	38.6	**44.8**	17
SRP	15.8	18.5	4.2	**12.8**	6
TN	1.440	1.670	1.320	**1.477**	1.1
TON	0.376	0.718	0.202	**0.432**	0.71
Nitrite	0.003	0.007	0.002	**0.004**	-
Chl *a*	3.8	3.0	1.7	**2.8**	11.5
DOC	16.0	17.7	14.4	**16.0**	
pH	7.30	7.37	7.49	**7.38**	8.1
Alk	46	41	46	**44**	27.4
Cond	142	135	135	**137**	160
Ca^{2+}	17.2	15.9	16.3	**16.5**	21
Mg^{2+}	3.5	3.2	3.2	**3.3**	4.6
Na^{+}	7.3	7.0	7.3	**7.2**	7.6
K^{+}	3.4	3.4	3.0	**3.3**	2.1
Cl^{-}	13.9	13.4	14.7	**14.0**	16.5
SO_4^{2-}	9.5	10.4	9.5	**9.8**	17.1

The water chemistry of Drumlougher Lough is typical for a medium alkalinity mesotrophic lough, with circumneutral pH and slightly elevated ionic concentration.

Total phosphorus is however well above the target level set in the CSM guidelines for oligo-mesotrophic loughs (10-20 μgl^{-1} JNCC 2015). Although the current data is missing a summer value, the mean of three quarterly samples was 44.8 μgl^{-1} which is significantly higher than the value recorded from the site in 1990 (17 μgl^{-1}) and suggests the site is undergoing further enrichment. Total nitrogen was also high for this site type, and although just within the CSM limit if 1.5 mgl^{-1}, appears to have increased since 1990 and is therefore of concern. Catchment sources of nutrients are most likely to be agricultural in origin. Agricultural improvement of the pasture to the north and west of the site requires careful management and activities such as slurry spreading of fields sloping to the lake shire should be discouraged (The site photo above shows recent slurry application to the field sloping down to the south west shore).

Chlorophyll *a* concentrations were low during the winter months, but increased in April 2015. The site has clearly suffered from eutrophication and this is likely to have been the main cause of the decline in *L. uniflora* within the lough. The current trophic status is unfavourable and recovery of the site would require investigation and reduction of external nutrients sources to the site.

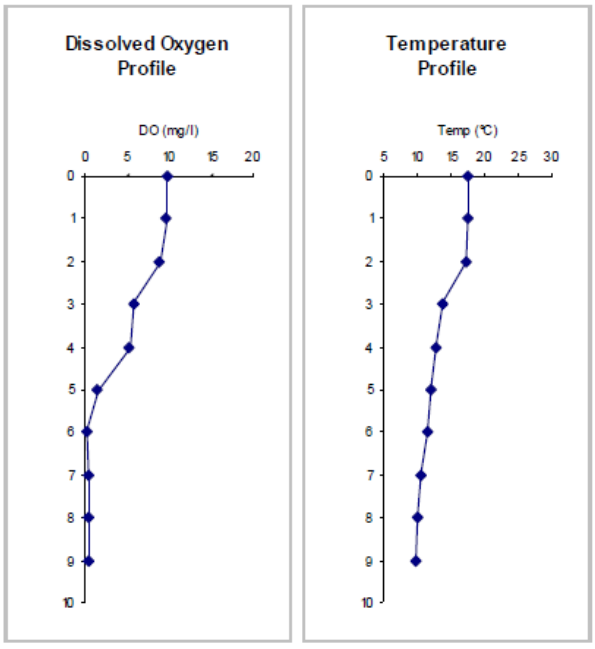
Dissolved oxygen concentrations were good above 3 m, but declined rapidly to near zero below this (Figure 38). A mean DO of 1.95 falls below the GES target adopted in the 2015 CSM guidance (JNCC 2015)

Figure 38 Dissolved oxygen and temperature profile for Drumlougher Lough (21/06/2015)

Dissolved Oxygen Profile

GPS Location	H8942418661
Maximum Depth (m)	9.5 m
Secchi Depth (cm)	115 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	9.82	17.6
1	9.58	17.6
2	8.89	17.2
3	5.86	13.8
4	5.19	12.8
5	1.34	12.1
6	0.27	11.4
7	0.32	10.5
8	0.33	9.9
9	0.36	9.8



Hydrology

The hydrological regime at the site appears to be under natural control, although historical drainage works do exist around the site outflow and are likely to have been responsible for some change to the water levels. The extent to which this impacts

the site now is unknown, but it is suggested that water levels should be maintained at least at the present height to ensure the wetland areas are preserved.

Lake substrate

The lake margins are predominantly organic silts and peat made up from the surrounding fen vegetation. The littoral substrates are predominantly organic and the open water has fine silty substrates.

Sediment load

There was no evidence of increased sediment loads, but eutrophication will increase internal productivity and potentially cause higher sedimentation rates. The application of slurry to adjacent fields is also likely to contribute to the in wash of fine material, as well as nutrients.

Indicators of local distinctiveness

The site was designated as an ASSI on the basis of the quality of the fen and wetland habitats rather than open water features.

Summary

Drumlougher Lough is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”. The site has relatively extensive wetland habitats of both base-rich and acid fen for which it was initially designated as an ASSI. Past data show the site to have been unfavourable condition prior to designation in 2000 (based on number of characteristic taxa recorded by NILS in 1990), but also show *L. uniflora* as abundant and therefore the site has declined significantly since 1990.

With the exception of high TP and TN, the water chemistry recorded in Drumlougher Lough is typical of mesotrophic waters, having circumneutral pH, and moderate ionic concentrations. Based on a single spot sample, TP concentrations were just within the CSM limit for mesotrophic waters in 1990, but have since increased significantly suggesting that eutrophication is on-going and remains a threat to the site. The current water quality and aquatic macrophyte flora is well below that expected for oligo-mesotrophic waters and therefore the lough is classified as **unfavourable** for its designated type.

Management of the open water should focus on identifying and reducing any nutrient inputs to the lough. In particular, management of the adjacent farmland to the west and north of the site should ensure best practice is followed for livestock grazing, fertilizer and slurry / manure application. Restoration targets for this lough would also be better informed by the setting of site specific species targets based on palaeoecological studies that can determine the historical plants assemblages. Palaeoecological analysis could also be used to determine the extent and timing of the ecological and trophic change at the site.

Table 169 Drumlougher Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Drumlougher Lough NI Lake 1175	**Unfavourable**	High TP Decline in abundance of *L. uniflora.* Poor distribution of characteristic species	Drumlougher Lough has extensive areas of species rich wetland which remain the primary ecological interest at the site. The open water is species poor and eutrophic and lacks a characteristic flora Site specific floristic targets should be defined and management should focus on identifying and reducing nutrient inputs through.

Species list

Table 170 List of all plant species recorded at Drumlougher Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Alisma plantago-aquatica	R
Angelica sylvestris	R
Cardamine pratensis	R
Carex curta	R
Carex echinata	R
Carex flacca	R
Carex nigra	F
Carex panicea	R
Carex rostrata	F
Carex viridula subsp. *oedocarpa*	R
Eleocharis palustris	O
Epilobium palustre	R
Equisetum fluviatile	F
Filipendula ulmaria	O
Galium palustre	O
Hydrocotyle vulgaris	R
Juncus articulatus	F
Juncus effusus	O
Liverworts unid	R
Lotus pedunculatus	R
Lycopus europaeus	R
Menyanthes trifoliata	O
Mosses unid	O
Myosotis laxa	R
Osmunda regalis	R
Pedicularis palustris	R
Phalaris arundinacea	R
Potentilla erecta	R
Potentilla palustris	O
Ranunculus flammula	R
Salix sp.	R
Senecio aquaticus	R
Sparganium erectum	R
Succisa pratensis	R
Typha latifolia	R
Veronica scutellata	R
Submerged & floating species	**% Frequency (n = 59)**
Eleogiton fluitans	+
Fontinalis antipyretica	3
Lemna trisulca	2
Littorella uniflora	5
Nuphar lutea	61
Nymphaea alba	2
Potamogeton alpinus	9
Potamogeton natans	15
Sparganium angustifolium	5
Utricularia vulgaris agg.	+

Survey data

Site Condition Assessment: Drumlougher Lough (21/06/2015)

Lake Details		Survey Details		
Lake Name	Drumlougher Lough	Survey Date	21/06/2015	
SSSI Name		Surveyors	BG & MST	
SAC Name		Shore Surveys	2	out of
Grid Ref	H894187	Wader Surveys	2	2
WBID / NI No.	50360 / 1175	Boat Surveys	2	sections

Site Notes:
Very brown water. Agricultural catchment with slurry spreading on only.
pasture sloping to the lake N.

Survey Notes:
Marginal substrate mainly peat. Littorella to 50 cm

Mixed lilies to around most of lough to c. 1.8 m (more

alba on S side) and sparse P. natans to 2.3

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	250 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	190 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	8 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H8946418603	H8943718516	H8946918553	H8945118565
Section	**2**	H8935918658	H8938918756	H8936318708	H8938118703

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3362	3363	3364
Section	**2**	3368	3369	3375

3.33. Aughnadarragh Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*.

Survey Date	21 June 2015
NI Lake Number:	1408
WBID:	50392
County:	Down
Grid reference:	J443594
OS Grid reference (X,Y):	344323,359434
Shoreline development index:	1.145
Surface area (ha.):	2.25
Maximum recorded depth (m):	1.25

Table 171 Condition Assessment Summary Table for Aughnadarragh Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓?	Site shallow with extensive wetlands.
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic Littorelletea species (≥ 2 if valid reasons suggest otherwise)	X	2 present: *Apium inundatum* and *Littorella uniflora*
	Mesotrophic: ≥ 3 Characteristic *Potamogeton* spp. and ≥ 8 others characteristic species	X	No characteristic broadleaf *Potamogeton* spp. and only 2 other characteristic spp.*: as above.*

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	*Utricularia vulgaris* was recorded in 1990 (NILS).
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	Only 6% of vegetated sample spots comply for oligo-mesotrophic spp.
Negative indicator species	Non-native species absent or present at low frequency	**X?**	*Elodea canadensis* at 41% frequency. No significant increased since 1990. *Lemna minuta* also recorded
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	No filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Margins with species rich wetland flora dominated by *Carex rostrata, Equisetum fluviatile, Typha latifolia* & *Menyanthes trifoliata*. Site shallow throughout and dominated by *F. antipyretica* with *L. trisulca, S. emersum* & *E. canadensis* all frequent. *N. lutea* & *P. natans* were also common beyond the reed edge. *L. uniflora* was present in S2 (as well as to N of site). A single record only for *A. inundatum.* Being very shallow and with few characteristic species, there was no characteristic zonation.
	Maximum depth distribution should be maintained	✓**?**	Z_{max} = 1.25 m, Z_s = > 1.25 m, Z_v = 1.25 m.
	At least the present structure should be maintained	**X?**	NILS data (1990) suggests *L. uniflora* & *A. inundatum* to be more frequent.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 μgl^{-1} Mesotrophic = 20 μgl^{-1}	**X**	TP = 36 μgl^{-1} (range 18 - 37) & TN = 1.4 mgl^{-1} (Nov'14 – Apr'15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.21 (range = 7.1-7.3). Stable, albeit just above 7.0.
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	Water well oxygenated and mixed. Mean DO > 8.7 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	None recorded and Chl a values low throughout sampling period (Nov'14 – Apr'15).
Hydrology	Natural hydrological regime	✓**?**	Unknown. Possibly some historical drainage of wetlands.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓	No recent change
	Natural and characteristic substrate maintained	✓	Predominantly organic / peat margins with occasional rock and sand. Silts in open water.
Sediment load	Natural sediment load maintained	✓	No evidence of increased siltation.
Indicators of local distinctiveness	Distinctive elements maintained	-	Surrounding wetland habitat is of high ecological value.
	Minimal negative impacts and no fish farming	✓?	Improved pasture around site and intensive livestock barns directly upstream from site. Impact unknown.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

Arial photography shows the outline of the wetland area to extend some distance to the south west of the open water and given the shallow topography of the basin it is likely the lake was once larger and has slowly transgressed to wetland. The current extent of the lake appears stable, but it is very shallow and further encroachment of the reed fringe should therefore be monitored to ensure the extent of open water is not being reduced.

Macrophyte community composition

The site has an extensive wetland flora, the majority of which were not surveyed within this project. At the lough margin, Common species included: *Menyanthes trifoliata, Eleocharis palustris, Carex rostrata,* Equisetum *fluviatile, Typha latifolia, Juncus effuses, Galium palustre, Oenanthe crocata, Mentha aquatica, Angelica sylvestris* and *Potentilla palustris.* The wetland area to the south west and east of the lough is particularly species and extensive and is the primary reason for ASSI selection.

The open water macrophyte assemblage falls well short of the required targets for this site type. *Littorella uniflora* and *Apium inundatum* were the only characteristic species recorded and these were rare within the site (although *L. uniflora* was also noted outside the survey sections near the north shore). Other species present are more typical of eutrophic waters and included *Fontinalis antipyretica Elodea canadensis, Lemna minor, L. trisulca, Nuphar lutea, Potamogeton natans, P. obtusifolius, Chara virgata* and *Sparganium emersum.* Given the mainly base rich geology of this area, the lough is best classified as being towards the mesotrophic end of the Annex 1, H3130 type. The basin is very shallow, only 125 cm at the deepest point, and therefore might not be expected to support a full array of mesotrophic species as listed in the CSM guidance (JNCC 2015). This assemblage is similar to that recorded in 1990 (NILS), although *L. uniflora* and *A. inundatum* were recorded at an abundance of “3” and “2” (1-5 scale) suggesting they were more abundant than in 2015 with “Charophytes” (unidentified) dominating. *Elodea* was present in 1990 and shows little change within the site, whereas *F. antipyretica* appears to have increased considerably. *Utricularia vulgaris, P. berchtoldii, P.*

crispus and *Callitriche hermaphroditica* were also recorded in 1990, but not seen in 2015. The flora was unfavourable in 1990, and remains so in 2015.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 8.0 and 6.88 respectively which remains very similar to the 1990 scores (Table 172) indicative of enrichment.

Table 172 Aquatic macrophyte community composition for Aughnadarragh Lough, including trophic scores

	1990 (NILS)			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=74)***
Apium inundatum	**7.0**	**7.50**	**2**	**7.0**	**7.50**	**1**
Chara virgata	8.5	7.69	5	8.5	7.69	11
Callitriche hermaphroditica	8.5	7.69	2	-	-	-
Elodea canadensis	8.5	7.95	4	8.5	7.95	41
Fontinalis antipyretica	6.3	5.38	3	6.3	5.38	54
Lemna minor	9.0	8.85	3	9.0	8.85	7
Lemna minuta	-	-	-	-	-	1
Lemna trisulca	10.0	8.85	-	10.0	8.85	65
Littorella uniflora	**6.7**	**4.23**	**3**	**6.7**	**4.23**	**8**
Nuphar lutea	8.5	6.92	3	8.5	6.92	27
Potamogeton berchtoldii	7.3	7.69	2	-	-	-
Potamogeton crispus	8.5	7.95	1	-	-	-
Potamogeton natans	6.7	4.23	2	6.7	4.23	24
Potamogeton obtusifolius	7.3	6.54	3	7.3	6.54	9
Sparganium emersum	10.0	7.50	2	10.0	7.50	18
Utricularia vulgaris	**5.5**	**4.23**	**1**	**-**	**-**	**-**
Average score	**7.9**	**6.88**		**8.0**	**6.88**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis has been a component of the flora since before 1990, and its current abundance is probably slightly less than the levels recorded in 1990 (recorded as “4” on a 1-5 scale). Its presence at the site along with very dense cover by *F. antipyretica* occupies most of the available habitat that would normally be expected to support an Isoetid flora. The presence of these species at high abundance is therefore unfavourable. The non-native duckweed *Lemna minuta* was also recorded in the site. Despite relatively high nutrients filamentous algae cover was low.

Macrophyte community structure

The marginal wetlands represent good examples of alkaline fen and willow carr that grade naturally from rough and semi improved pasture to a mosaic of mossy fen to tall herb fen at the waters edge. Within the open water, *F. antipyretica* dominates with *L. trisulca* and *E. canadensis* throughout. Due to the site being so shallow, there are plants across the entire basin and these form a patchy mosaic rather than having the characteristic zonation seen in deep mesotrophic loughs. Where it occurred, *L. uniflora* formed relatively dense beds at 25-75 cm depth. *Nuphar lutea* and *P. natans* were more common around the west shore, but also in sparse patches throughout the lough.

Water quality

Table 173 Water chemistry data for Aughnadarragh Lough

	Nov '14	Feb'15	Apr'15	Mean	1990
TP	36.8	18.2	36.4	30.5	27
SRP	5.9	4.3	8.4	6.2	0.0
TN	1.610	1.280	1.310	1.400	1.00
TON	0.208	0.092	0.006	0.102	0.01
Nitrite	0.002	<0.001	<0.001	<0.001	-
Chl *a*	3.8	3.0	1.7	2.8	1.2
DOC	19.9	19.0	18.1	19.0	-
pH	7.25	7.11	7.28	7.21	8.01
Alk	39	32	37	36	38
Cond	161	151	168	160	194
Ca^{2+}	13.2	11.7	12.8	12.6	10.4
Mg^{2+}	4.4	3.9	4.4	4.2	4.8
Na^{+}	14.2	13.7	15.8	14.6	14.5
K^{+}	3.5	2.7	2.3	2.8	1.7
Cl^{-}	26.0	24.7	28.8	26.5	29.1
SO_4^{2-}	9.0	9.7	8.6	9.1	12.0

The water chemistry of Aughnadarragh Lough is typical for a medium alkalinity mesotrophic lough, with circumneutral pH and slightly elevated ionic concentration. Total phosphorus is however above the target level set in the CSM guidelines for shallow mesotrophic loughs (20 μgl^{-1} JNCC 2015). Although the current data is missing a summer value, the mean of 3 quarterly samples was 30.5 μgl^{-1} which is similar to value recorded from the site in 1990 (27 μgl^{-1}). Despite the high nutrients, Chl *a* levels remained relatively low and the water was clear during sampling visits and without any filamentous algae. The site has clearly suffered from eutrophication and being so shallow, it probably has less resilience to enrichment than deeper loughs. The current trophic status is unfavourable and recovery of the site would require investigation and reduction of external nutrients sources to the site.

Dissolved oxygen concentrations were good at the time of sampling. (Figure 39).

Hydrology

The hydrological regime at the site appears to be under natural control, although historical drainage works do exist and these should remain blocked to ensure water levels do not drop.

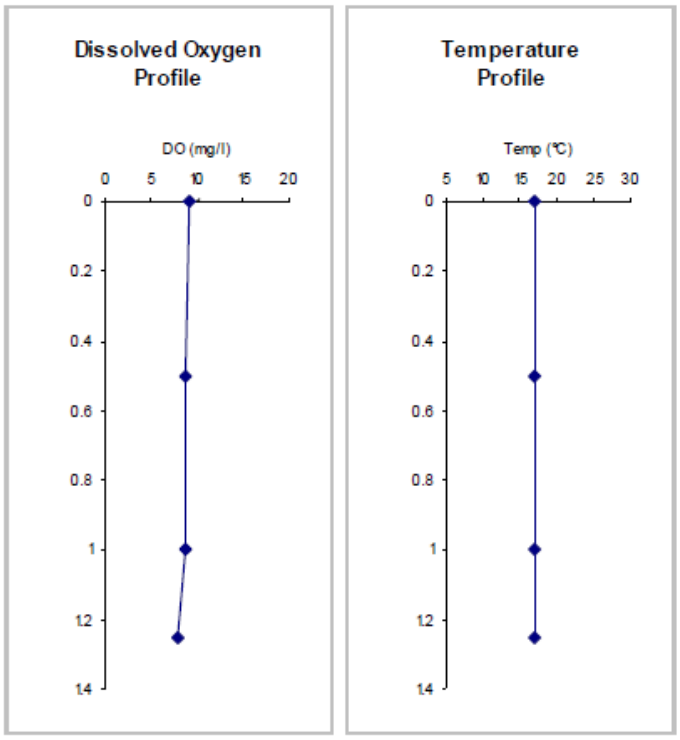
Figure 39 Dissolved oxygen and temperature profile for Aughnadarragh Lough (20/06/2015)

Dissolved Oxygen Profile

GPS Location	J4441059458
Maximum Depth (m)	1.25 m
Secchi Depth (cm)	-

Notes: Secchi > max depth

Depth (m)	DO (mg/l)	Temp (°C)
0	9.16	17
0.5	8.8	17
1	8.85	17
1.25	7.93	17



Lake substrate

The lake margins are predominantly organic silts and peat made up from the surrounding fen vegetation. There are some areas with more mineral substrates in the littoral zone with sand, pebbles and cobbles recorded in section 2. The majority of the open water has fine silty substrates.

Sediment load

There was no evidence of increased sediment loads from external sources, but eutrophication will increase internal productivity and potentially cause higher sedimentation rates and reed encroachment. This should be monitored to prevent any loss of open water habitat.

Indicators of local distinctiveness

The site was designated as an ASSI on the basis of the quality of the fen and wetland habitats rather than open water features.

Summary

Aughnadarragh Lough is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”. The site is very shallow and surrounded by base-rich fen and is not therefore typical of this standing water type. As such it is unlikely that the lough would have ever supported a characteristic mesotrophic flora of the type defined within the CSM

guidance (JNCC 2015). Nonetheless, a favourable assemblage would still be expected to have much greater abundance of *L. uniflora* as well as a number of other mesotrophic species that were not recorded in the current survey. Eutrophication is most likely cause for the poor floristic quality.

With the exception of high TP, the water chemistry is typical of mesotrophic waters, having circumneutral pH, and moderate ionic concentrations. TP concentrations were above target values in 1990 as well as 2015 which suggests nutrient pollution is on-going at the site. The current water quality and aquatic macrophyte flora are more indicative of eutrophic conditions and therefore the lough is classified as **unfavourable** for its designated type. Management of the open water should focus on identifying and reducing any nutrient inputs to the lough. The CSM guidance for mesotrophic lakes is focused more towards larger and deeper lakes than Aughnadarragh Lough and therefore the condition targets are set rather too high for this small shallow site. Sites like this would be better assessed against site specific restoration targets based on palaeoecological studies that can determine the historical plants assemblages and potentially also the timing and cause of its decline.

Table 174 Aughnadarragh Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Aughnadarragh Lough NI Lake 1408	**Unfavourable**	High TP High cover of non-native species. Lack of characteristic species	Aughnadarragh Lough has extensive areas of species rich wetland. The open water is eutrophic and dominated by non-characteristic and non-native species. Site specific floristic targets should be defined and management should focus on identifying and reducing nutrient inputs.

Species list

Table 175 List of all plant species recorded at Aughnadarragh Lough

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Angelica sylvestris	F
Cardamine pratensis	O
Carex curta	O
Carex nigra	R
Carex rostrata	A
Carex viridula subsp. *oedocarpa*	R
Eleocharis palustris	F
Epilobium hirsutum	R
Epilobium palustre	O
Equisetum fluviatile	A
Equisetum palustre	R
Eriophorum angustifolium	O
Filipendula ulmaria	O
Galium palustre	F
Hydrocotyle vulgaris	O
Juncus articulatus	R
Juncus effusus	F
Luzula multiflora	R
Lychnis flos-cuculi	R
Lycopus europaeus	O
Mentha aquatica	F
Menyanthes trifoliata	A
Myosotis scorpioides	O
Oenanthe crocata	F
Phalaris arundinacea	O
Polytrichum commune	O
Potentilla palustris	O
Ranunculus flammula	O
Rumex acetosa	R
Rumex hydrolapathum	O
Senecio aquaticus	O
Sphagnum sp.	O
Typha latifolia	A
Veronica beccabunga	R

Submerged & floating species	% Frequency (n = 74)
Apium inundatum	1.4
Chara virgata	10.8
Elodea canadensis	40.5
Fontinalis antipyretica	54.1
Lemna minor	6.8
Lemna minuta	1.4
Lemna trisulca	64.9
Littorella uniflora	8.1
Nuphar lutea	27.0
Potamogeton natans	24.3
Potamogeton obtusifolius	9.5
Sparganium emersum	17.6

Survey data

Site Condition Assessment: Aughnadarragh Lough (21/06/2015)

Lake Details		**Survey Details**		
Lake Name	Aughnadarragh Lough	Survey Date	21/06/2015	
SSSI Name		Surveyors	ES JS	
SAC Name		Shore Surveys	2	out of
Grid Ref	J443594	Wader Surveys	2	2
WBID / NI No.	50392 / 1408	Boat Surveys	2	sections

Site Notes:
A shallow, site dominated by Fontinalis antipyretica in open water

Survey Notes:
Littorella present outside of the sections - particularly in front of the house, along with Chara virgata, S. emersum, P. obtusifolius

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	265 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	270 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Plants to max depth	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	J4426559417	J4427059511	J4427059455	J4434859437
Section	**2**	J4443659477	J4440659391	J4441959426	J4435359436

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	4288	4295	4302
Section	**2**	4303	4304	4306

3.34. Blue Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	27 August 2014
NI Lake Number:	1574
WBID:	50455
County:	Down
Grid reference:	J327252
OS Grid reference (X,Y):	332736,325215
Shoreline development index:	1.069
Surface area (ha.):	2.0
Maximum recorded depth (m):	5.0

Table 176 Condition Assessment Summary Table for Blue Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species listed (≥ 2 if valid reasons suggest otherwise)	✓	3 present: *Isoetes lacustris, Littorella uniflora, Lobelia dortmanna*.
	Mesotrophic: 8 characteristic species	**X**	No *Potamogeton* spp. present. 3 other species: *I. lacustris, L. uniflora, L. dortmanna*
	No loss of characteristic species	✓**?**	*Sparganium angustifolium* recorded in 1988 but not in 2006 or 2014. *L. uniflora* recorded in 2006 and 2014 but not in 1988.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	69% of vegetated sample spots comply for oligotrophic species
Negative indicator species	Non-native species absent or present at low frequency	✓	No non-natives recorded
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Overall cover < 10%
Macrophyte community structure	Characteristic vegetation zones should be present	✓**?**	Catchment of *Molinia* dominated, rough upland moorland. *Sphagnum* / *Eriophorum* fringe, particularly dense to S around outflow. Aquatic *Sphagnum* spp. & *J. bulbosus* present throughout from 0-75 cm. *L. dortmanna* dominant submerged plant – abundant from 25-190 cm, growing alongside *I. lacustris* (50-220 cm) and a little *L. uniflora* at shallower depths. *Batrachospermum* sp. present 75-220 cm. No submerged plants beyond 140 cm along steeply shelving, bouldery N side of lough; to 220 cm elsewhere.
	Maximum depth distribution should be maintained	✓	Z_{max} = 5.0 m, Z_s = 1.7 m, Z_v = 2.2 m
	At least the present structure should be maintained	✓	Similar structure to AWMN macrophyte survey in 1990 and previous survey in 2006.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1}	✓	TP = 4 µgl^{-1} (range 1.8 - 5.6) & TN = 0.99 mgl^{-1} (Mar'06 – Jan'07).
	Stable pH values: pH ~ 5.5 – circumneutral	✓**?**	pH = 5 (range = 5 – 5.1). Site acidic and low alkalinity
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	✓	Waters well oxygenated throughout: DO ~ 10 mgl^{-1} from 0-4.5 m water depth. No thermocline at the time of survey.
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	Predominantly peat catchment. Bouldery margins in many areas, with a matrix of silts between. Open water sediments similar.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓	No excessive erosion or grazing observed in catchment
Indicators of local distinctiveness	Distinctive elements maintained	✓?	None specified.
	Minimal negative impacts and no fish farming	✓	Low disturbance and grazing pressure.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is approximately 2.0 ha and there is no evidence of any loss of extent of the open water.

Macrophyte community composition

Table 177 Aquatic macrophyte community composition for Blue Lough, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=31)***	**TRS**	**PLEX**	**% occurrence (n=58)***
Isoetes lacustris	**5.0**	**4.23**	**35**	**5**	**4.23**	**27.6**
Juncus bulbosus	3.7	3.08	26	3.7	3.08	36.2
Littorella uniflora	**6.7**	**4.23**	**6**	**6.7**	**4.23**	**1.7**
Lobelia dortmanna	**5.0**	**3.08**	**71**	**5**	**3.08**	**55.2**
Sphagnums aquatic	3.7	1.54	23	3.7	1.54	39.7
Liverworts aquatic	-	-	-	-	-	19
Average score	**4.8**	**3.23**		**4.8**	**3.23**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys.

Blue Lough is a corrie lough in the Mourne Mountains. It lies within an upland catchment comprising peat and exposed rocky outcrops. Catchment vegetation consists of rough open moorland dominated by *Molinia caerulea.* The lough has a *Sphagnum* / *Eriophorum* transitional wetland fringe, which is most extensive to the south in the area around the outflow. Although the site supports only a limited number of aquatic macrophyte species, three characteristic *Littorelletea* species are present: *Isoetes lacustris, Littorella uniflora* and *Lobelia dortmanna*; indicating that the lough is in favourable condition. Their frequency across both the wader and boat transects (69%) meets the species frequency target of >60% of sample spots having 1 or more characteristic species. The only other non-characteristic submerged species growing in the lough were *Juncus bulbosus,* aquatic *Sphagnum* spp and aquatic liverworts (likely to be *Jungermannia sp.* (E. Shilland, pers. comm))

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 4.8 and 3.23 respectively (Table 177), which is the same as the scores calculated from the 2006 survey and suggest that there has been no

significant change in the lough's trophic status over this period. *Sparganium angustifolium* was present in the 1990 survey but was absent in 2006 and in the current survey, suggesting that it is now absent from the site.

Negative indicator species

J. bulbosus was present in 36% of the sample plots which is below the level indicative of negative conditions in oligotrophic lakes within the CSM guidelines (JNCC 2015). Filamentous algae occurred at low abundance. No alien species were recorded from the site.

Macrophyte community structure

A transitional *Sphagnum* / *Eriophorum* wetland fringe grows all around the lough and is particularly dense to the south around the outflow. The lough has only very slightly peaty brown water, therefore light penetration and hence the maximum depth of plant growth is relatively high (Z_{max} = 5.0 m, Z_s = 1.7 m; Z_v = 2.2 m). Both aquatic *Sphagnum* spp. and *J. bulbosus* are present throughout the lough, growing predominantly at water depths of 0 - 75 cm. *L. dortmanna* is the dominant submerged plant and is abundant at water depths of 25 - 190 cm, growing alongside *I. lacustris* (50 - 220 cm), whose growth extends into slightly deeper water. *L. uniflora* was recorded growing at low frequency at ~100 cm in S1 only. *Batrachospermum* sp. present at water depths of 75 - 220 cm. No submerged plants were recorded beyond a water depth of 140 cm along the steeply shelving, bouldery northern side of lough, but submerged aquatics were recorded growing to 220 cm elsewhere. The current structure is considered favourable.

Water quality

Table 178 Water chemistry data for Blue Lough

	May' 14	Aug' 14	Nov '14	Feb' 15	Mean	2006	1988
TP	3.2	5.6	5.3	1.8	**4**	4	12
SRP	1.3	<1	<1	<1	**<1.1**	-	2
TN	1.26	1.01	0.72	0.97	**0.99**	0.78	-
TON	1.13	0.66	0.43	0.74	**0.74**	-	-
Nitrite	<0.001	<0.001	<0.001	<0.001	**<0.001**	-	-
Chl *a*	2.42	7.01	2.31	0.88	**3.16**	5	3.07
DOC	2.6	5.16	4.54	3.02	**3.83**	-	-
pH	5.02	5	5.06	5.04	**5.03**	4.6	6.46
Alk	<5	<5	<5	<5	**<5**	1.1	0.25
Cond	59	39	42	45	**46**	43	72
Ca^{2+}	<1	<1	0.612	0.61	**<0.81**	1.3	0.8
Mg^{2+}	1.03	0.59	0.58	0.71	**0.73**	1.1	1
Na^{+}	6.79	4.59	5.12	5.26	**5.44**	4.9	5.05
K^{+}	0.52	0.39	0.44	0.39	**0.44**	0.3	0.5
Cl^{-}	12.5	7.2	9.1	9.2	**9.5**	9.9	7.86
SO_4^{2-}	<10	2.44	2.76	2.79	**<4.50**	3.4	6.18

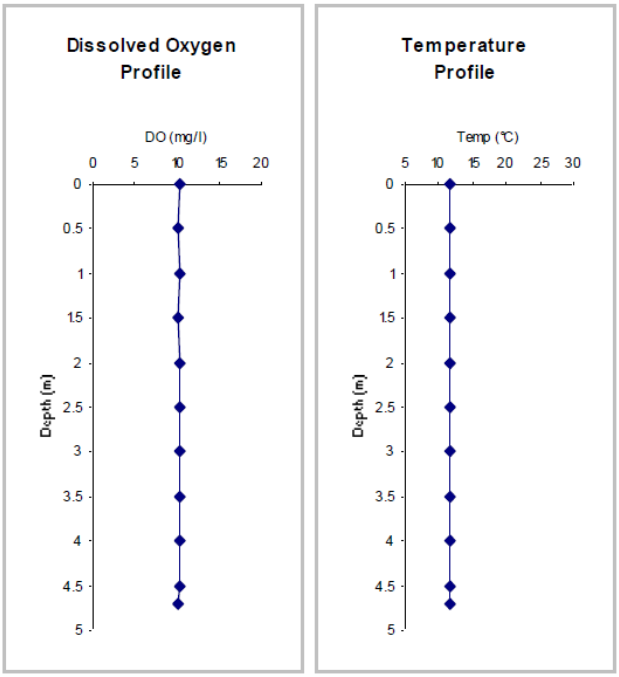
The water chemistry of Blue Lough is not entirely consistent with that of an oligotrophic water body. Although it has low nutrient and ionic concentrations, the mean pH is below 5.5, the alkalinity is < 10 mgl^{-1} and the colour of the water is very slightly brown (just above 30 mg Pt l^{-1}), all of which are more consistent with the 'Peat' lake type (Phillips, 2003). The mean annual TP concentration is very low (4 mgl^{-1}) and there is no evidence of nutrient enrichment and therefore the site is considered to be in favourable condition with respect to trophic status. At the time of survey in August 2014, the lake was well oxygenated throughout (DO from 0 – 4.5 m was ~10 mgl^{-1}).

Figure 40 Dissolved oxygen and temperature profile for Blue Lough (27/08/2014)

Dissolved Oxygen Profile

GPS Location	?
Maximum Depth (m)	5 m
Secchi Depth (cm)	170 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	10.25	11.6
0.5	10.14	11.6
1	10.22	11.6
1.5	10.13	11.6
2	10.24	11.6
2.5	10.25	11.6
3	10.27	11.6
3.5	10.24	11.6
4	10.26	11.6
4.5	10.25	11.6
4.7	10.15	11.6



Hydrology

Blue Lough has two inflow seeps / flushes to the north and the lough drains to the south through an area of *Sphagnum / Eriophorum* bog. The hydrological regime at the site appears natural.

Lake substrate

The lough margins predominantly comprise boulders with a matrix of silts in between. Open water sediments are similar.

Sediment load

There was no evidence of any increase in sediment loads from the catchment.

Indicators of local distinctiveness

None specified.

Summary

Blue Lough achieves both the necessary aquatic macrophyte compositional and structural targets for an oligotrophic lough as defined within the CSM guidance (JNCC 2015). The lough also meets the necessary water quality targets. Furthermore, there appears to have been little change in species composition over the last few decades and there are no significant catchment pressures that would suggest the lough's condition is under threat. The current assessment therefore considers Blue Lough to be in **favourable** condition.

Table 179 Blue Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Blue Lough NI Lake 1574	**Favourable**		Upland lough in favourable condition. *Littorelletea* flora present and showing typical zonation pattern, although only low frequency of *L. uniflora*. Water quality favourable, with low TP concentrations and no obvious catchment pressures.

Species list

Table 180 List of all plant species recorded at Blue Lough in 2014

Marginal & Emergent species	Abundance (DAFOR)
Calluna vulgaris	O
Eriophorum angustifolium	O
Carex nigra	R
Potentilla erecta	R
Juncus effusus	R
Schoenus nigricans	R
Submerged & floating species	**% Frequency (n = 58)**
Lobelia dortmanna	55.2
Isoetes lacustris	27.6
Littorella uniflora	1.7
Sphagnum sp.	39.7
Batrachospermum sp.	22.4
Liverworts aquatic	19.0
Juncus bulbosus	36.2

Survey Data

Site Condition Assessment: Blue Lough (27/08/2014)

Lake Details		**Survey Details**		
Lake Name	Blue Lough	Survey Date	27/08/2014	
SSSI Name		Surveyors	SD & ES	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	J327252	Wader Surveys	2	2
WBID / NI No.	50455 / 1574	Boat Surveys	2	sections

Site Notes:

survey

Survey Notes:
Surveyed with Ewan Shilland as part of UWMN

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	220 cm
		Compass bearing of boat transect (°)	335 °
		Lateral distance from waters edge to 75cm depth (m)	-
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	-
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	J3266125201	J3273425295	J3269025153	J3271625171
Section	**2**	J3273325120	J3284225252	J3269025153	-

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	-	-	-
Section	**2**	-	-	-

3.35. Greenan Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	20 June 2015
NI Lake Number:	1605
WBID:	50132
County:	Down
Grid reference:	J119232
OS Grid reference (X,Y):	311875,323200
Shoreline development index:	1.473
Surface area (ha.):	11.0
Maximum recorded depth (m):	8.1

Table 181 Condition Assessment Summary Table for Greenan Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	**X?**	Significant area of reed/Salix encroachment. Unknown if natural
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic Littorelletea species (≥ 2 if valid reasons suggest otherwise)	**X**	1 present: *Eleogiton fluitans* (but only recorded in the margins). No others recorded
	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	**X**	1 characteristic broadleaf *Potamogeton* spp.: *P. gramineus* and only 2 other characteristic spp.*: E. fluitans & N. flexilis* agg.

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	*Littorella uniflora* recorded in S2 in 2006, but not seen in 2015.
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	No oligotrophic species in open water and only 3% of vegetated sample spots comply for mesotrophic spp.
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* at 83% frequency. Significant increased since 2006. *Lemna minuta* also recorded
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Low cover of filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	**X**	Margins with emergent species dominated by *P. australis, S. lacustris* and *C. rostrata*. No characteristic oligotrophic species in open water. *E. canadensis* dominant within the photic zone to 3.1 m. *P. natans* more frequent within reeds to 0.75 m), *N. lutea* (1.0 – 2.4 m) and *S. emersum* sparse (0.5 – 2.7 m). *F. antipyretica* locally abundant to 3.1 m. No characteristic zonation.
	Maximum depth distribution should be maintained	✓	Z_{max} = 8.1 m, Z_s = 3.75 m, Z_v = 3.1 m.
	At least the present structure should be maintained	**X**	Increase in nuisance species.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1}	**X**	TP = 45 µgl^{-1} (range 31-71) & TN = 1.2 mgl^{-1} (Nov'14 – Apr'15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓**?**	pH = 6.97 (range = 6.7 – 7.9).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	**X**	Surface water well oxygenated, but falling to > 5 mgl^{-1} below the thermocline at 4 m (mean 1.7 mgl^{-1}) .
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓**?**	Unknown
Lake substrate	Natural shoreline maintained	✓**?**	Mostly natural, but with disused fishing platforms and ditches close to shore.

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	✓	Predominantly reed-fringed with deep organic marginal substrates. Silts in open water.
Sediment load	Natural sediment load maintained	✓?	No evidence of increased siltation – but encroachment of marginal habitats suggests possible siltation.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓?	Improved pasture around site and intensive livestock barns directly upstream from site. Impact unknown.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lough is listed as being 11.0 ha, but in reality a significant part of the open water has in-filled with reed bed and willow, with the south now having a separate area of water enclosed by wetland vegetation. A local land owner suggested this area had all been part of the open water within his lifetime (60 years?) and therefore there has been significant encroachment at the site in recent years with the current extent of open water estimated to be only 7 ha. Arguably this could simply be the natural development of the lough, but in light of the nutrient enrichment (see below), it is likely that the speed of reed growth and subsequent terrestrialisation of the south and west of the lough has been accelerated by eutrophication and consequent loss of marginal oligotrophic habitat.

Macrophyte community composition

The emergent marginal flora is very extensive and dominated by *Schoenoplectus lacustris, Phragmites australis, Carex rostrata* and *Menyanthes trifoliata,* often backed by with *Salix* spp. Within the reeds, submerged aquatic plants were common, but no characteristic oligotrophic species were present. *Littorella uniflora* was recorded as frequent ('3' on a scale of 1-5) in 1990 (NILS), rare in 2006 and was recorded in the margins as well as in the water. It was not found in 2015, despite extensive searches. *Lobelia dortmanna* was also recorded as frequent in the NIL survey carried out in 1990, but was not seen in 2006 or 2015 suggesting that it has been lost from the site. Only one characteristic broad leaved *Potamogeton* spp. (*P. gramineus*) was recorded, and only at one location. Other species typical of oligo-mesotrophic loughs that were recorded in 1990 also appear to have been lost, or at least significantly declined e.g. *Myriophyllum alterniflorum, Eleogiton* (*Isolepis*) *fluitans* and *P. perfoliatus.*

Instead of a characteristic flora, the site was dominated in open water by Elodea canadensis, Fontinalis antipyretica and Lemna trisulca with *Nuphar lutea, Nymphaea alba, P. obtusifolius* and *Sparganium emersum* also frequent (Table 182), all species more typical of eutrophic waters. *Potamogeton berchtoldii* and *Ceratophyllum demersum* were both recorded in 2006, but absent in 2015. The macrophyte assemblage has declined significantly since 1990, with a further decline since 2006 and therefore remains unfavourable within the guidelines defined in the CSM (JNCC

2005 and 2015). The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) of the site were 7.6 and 6.64 respectively which is similar to 1990 (7.7 and 6.54 respectively) (Table 182).
One notable find was the liverwort *Riccia fluitans,* recorded from two different localities within the lough. This species is relatively rare in Northern Ireland (Atherton *et a*l. 2010)

Table 182 Aquatic macrophyte community composition for Greenan Lough, including trophic scores.

	2006			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=36)***	**TRS**	**PLEX**	**% occurrence (n=50)***
Ceratophyllum demersum	10.0	8.85	26	-	-	-
Chara virgata	8.5	7.69	20	8.5	7.69	1
Eleogiton fluitans	**-**	**-**	**-**	**4.0**	**3.08**	**+**
Elodea canadensis	8.5	7.95	49	8.5	7.95	83
Fontinalis antipyretica	6.3	5.38	6	6.3	5.38	58
Lemna minor	9.0	8.85	3	9.0	8.85	1
Lemna minuta	-	-	-	-	-	3
Lemna trisulca	10.0	8.85	3	10.0	8.85	61
Littorella uniflora	**6.7**	**4.23**	**6**	**-**	**-**	**-**
Nitella flexilis agg.	-	-	-	5.5	5.38	2
Nuphar lutea	8.5	6.92	23	8.5	6.92	43
Nymphaea alba	6.7	3.08	54	6.7	3.08	27
Potamogeton berchtoldii	7.3	7.69	20	-	-	-
Potamogeton gramineus	**7.3**	**7.31**	**11**	**7.3**	**7.31**	**1**
Potamogeton natans	6.7	4.23	6	6.7	4.23	21
Potamogeton obtusifolius	7.3	6.54	14	7.3	6.54	25
Potamogeton polygonifolius	3.0	3.08	3	-	-	-
Riccia fluitans	-	-	-	-	-	4
Sparganium emersum	10.0	7.50	29	10.0	7.50	30
Average score	**7.7**	**6.54**		**7.6**	**6.64**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Although *Elodea canadensis* has been a component of the flora since before 1990, its presence at 83% frequency is unfavourable. The non-native duckweed *Lemna minuta* was also recorded in the site. Filamentous algae cover was low.

Macrophyte community structure

The site is surrounded by steep sloping pasture, much of which is improved. The lough is fringed by extensive reed beds with *Schoenoplectus lacustris* along the east and northern margins with *Phragmites australis* and *Carex rostrata* frequently

occurring. Beyond the reed edge (1-1.4 m), the lack bed shelved steeply around much of the lake to in excess of 2.5 m. The water was very clear however and although the site lacked a characteristic flora, the other submerged macrophytes formed extensive beds, dominated by *E canadensis* to 2.8-3.6 m. *Potamogeton* spp. and *Nymphaea alba* were prevalent in the shallower waters (0.25 – 1.0 m), with *Nuphar lutea* more common in deeper water (1.0 – 2.4 m).

Water quality

The general water chemistry of Greenan Lough is typical for a low to moderate alkalinity mesotrophic lough, having a circumneutral pH and slightly elevated ionic concentration. Total phosphorus is however well above the target level set in the CSM guidelines shallow oligotrophic or mesotrophic loughs (10 & 20 μgl^{-1} JNCC 2015). Although the current for data is missing a summer value, the mean of 3 quarterly samples was 45 μgl^{-1} which is higher than the 2006 and approaches the high value recorded in 1990 (58 μgl^{-1}). Despite the high nutrients, Chl *a* levels remained relatively low and the water clear during sampling visits and without any filamentous algae. The site has clearly suffered from eutrophication and it is recommended that point-source and diffuse pollution within the catchment is investigated to determine if the problem is on-going.

Dissolved oxygen concentrations were good in the surface water, but fell to near zero below 4.0 m (Figure 41).

Table 183 Water chemistry data for Greenan Lough

	Nov '14	Feb'15	Apr'15	Mean	2006	1990
TP	70.7	34.5	30.5	**45.2**	23.5	58.0
SRP	41.2	20.8	4.3	**22.1**		
TN	1.330	1.350	0.900	**1.193**	1.1	1.0
TON	0.390	0.670	0.064	**0.375**		
Nitrite	0.006	0.003	0.002	**0.004**		
Chl *a*	2.040	2.9	5.8	**3.6**	5.6	84.8
DOC	9.9	4.2	4.7	**6.3**		
pH	6.65	7.06	7.89	**6.97**	7.6	7.4
Alk	38	49	56	**48**	58.8	38.7
Cond	170	180	174	**175**	213	200
Ca^{2+}	15.5	18.4	17.7	**17.2**	30.7	27.8
Mg^{2+}	4.2	4.8	4.7	**4.6**	9.6	5.0
Na^{+}	10.2	10.0	10.1	**10.1**	8.5	10.4
K^{+}	5.6	3.8	3.8	**4.4**	3.7	1.6
Cl^{-}	19.4	17.6	17.6	**18.2**	11.1	16.8
SO_4^{2-}	14.9	12.3	13.3	**13.5**	15.7	9.3

Hydrology

The hydrological regime at the site appears natural.

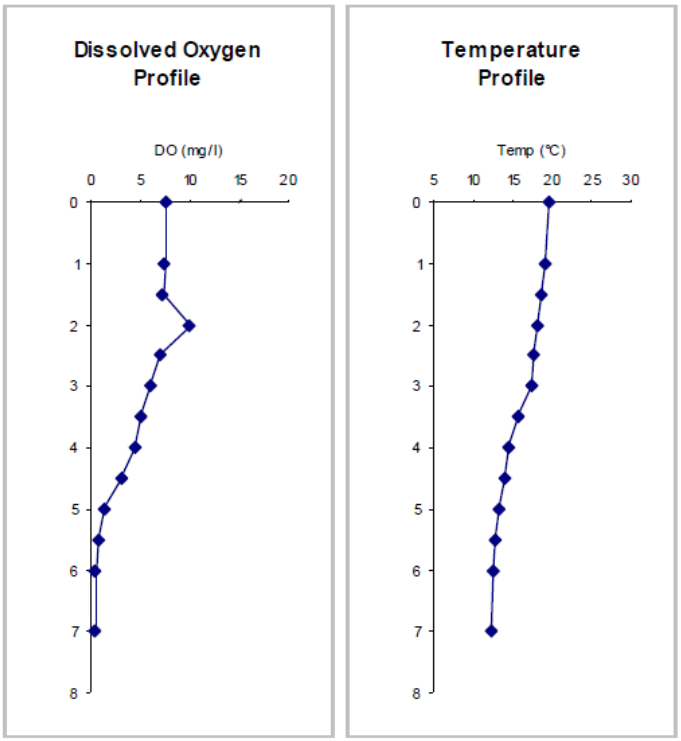
Figure 41 Dissolved oxygen and temperature profile for Greenan Lough (20/06/2015)

Dissolved Oxygen Profile

GPS Location	J1188623287
Maximum Depth (m)	7 m
Secchi Depth (cm)	375 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	7.58	19.5
1	7.42	19.1
1.5	7.16	18.5
2	9.96	18
2.5	6.92	17.7
3	6.01	17.4
3.5	5.13	15.8
4	4.38	14.5
4.5	3.09	13.9
5	1.35	13.2
5.5	0.75	12.8
6	0.36	12.5
7	0.39	12.2



Lake substrate

The lake margins are characterised by exposed boulders at the waterline, often with consolidated organic sediments within the reeds. The open water substrates are silty.

Sediment load

Given the increased productivity of the catchment and lakes, it should be assumed that internal production and sedimentation are likely to have increased. Most of the surrounding pasture is grazed and there was some evidence of poaching in the lough margins.

Indicators of local distinctiveness

The liverwort *Riccia fluitans* was recorded at two locations within the lough in 2015. This species is widely distributed, but there are relatively few records from Northern Ireland (Atherton *et al* 2010).

Summary

Greenan Lough is classified as an “oligotrophic to mesotrophic standing water with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*”, but retains very few characteristic features of this site type as defined within the CSM guidance (JNCC 2015). Furthermore the site has lost characteristic oligotrophic species over the past 25 years, with the decline still on-going and the non-native

Elodea canadensis now dominating the aquatic flora. Eutrophication is most likely cause for this decline in floristic quality and also been responsible for accelerated the reed growth of the marginal areas with a significant loss of open water habitat.

The water chemistry is most typical of mesotrophic waters, having circumneutral pH, and moderate ionic concentrations. Although Chl a has remained low through this study, the TP was higher than in 2006 and suggests nutrient pollution remains a problem at the site. The water quality and aquatic macrophyte flora are more indicative of eutrophic conditions and therefore the lough is classified as **unfavourable** for its designated type. With a large number of dwellings and agricultural premises around the site, diffuse as well as point source input are likely to be a problem and management of the site should focus on identifying and reducing these inputs to the lough. Palaeoecological studies could help to determine the timing and cause for the decline and also help to determine the past flora of this site and so set realistic restoration targets.

Table 184 Greenan Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Greenan Lough NI Lake 1605	**Unfavourable**	High TP High cover of non-native species. Loss of characteristic species Loss of open water habitat	Geenan Lough no longer has any significant characteristic features and has declined since 2006. Eutrophication is likely to be the main cause of decline and management should focus on identifying and reducing nutrient inputs.

Species list

Table 185 List of all plant species recorded at Greenan Lough

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	O
Alopecurus geniculatus	R
Angelica sylvestris	R
Apium nodiflorum	R
Cardamine pratensis	R
Carex curta	R
Carex echinata	R
Carex nigra	R
Carex remota	R
Carex rostrata	F
Cirsium palustre	R
Epilobium hirsutum	R
Epilobium palustre	R
Epilobium tetragonum	R
Equisetum fluviatile	O
Filipendula ulmaria	O
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus articulatus	O
Juncus effusus	O
Lotus pedunculatus	R
Lychnis flos-cuculi	R
Lycopus europaeus	R
Mentha aquatica	O
Menyanthes trifoliata	F
Myosotis laxa	R
Phalaris arundinacea	R
Phragmites australis	F
Potentilla erecta	R
Potentilla palustris	O
Ranunculus flammula	R
Rorippa nasturtium-aquaticum	R
Salix sp.	R
Schoenoplectus lacustris	F
Solanum dulcamara	R
Typha latifolia	R
Veronica beccabunga	R
Veronica scutellata	R

Submerged & floating species	% Frequency (n = 105)
Chara virgata	1.0
Eleogiton fluitans	+
Elodea canadensis	82.9
Fontinalis antipyretica	58.1
Lemna minor	1.0
Lemna minuta	2.9
Lemna trisulca	61.0
Nitella sp.	1.9
Nuphar lutea	42.9
Nymphaea alba	26.7
Potamogeton gramineus	1.0
Potamogeton natans	21.0
Potamogeton obtusifolius	24.8
Riccia fluitans	3.8
Sparganium emersum	29.5

Survey data

Site Condition Assessment: Greenan Lough (20/06/2015)

Lake Details		**Survey Details**		
Lake Name	Greenan Lough	Survey Date	20/06/2015	
SSSI Name		Surveyors	BG, ES, JS	
SAC Name		Shore Surveys	3	out of
Grid Ref	J119232	Wader Surveys	3	3
WBID / NI No.	50132 / 1605	Boat Surveys	3	sections

Site Notes:
Jetties for fishing - now mainly disused.

Survey Notes:
S2 has over 100 m of dense reedbed from shore to 100 cm water depth. South end now separate from north with some open pool areas. Inflow area very rich / lush – looks to be eutrophic inputs. Water very clear and very slightly brown.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	310 cm
	Compass bearing of boat transect (°)	240 °
	Lateral distance from waters edge to 75cm depth (m)	15 m
	Notes:	
Section 2	Maximum depth of colonisation (cm)	360 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	100 m
	Notes: GPS points moved to outer edge of reeds	
Section 3	Maximum depth of colonisation (cm)	280 cm
	Compass bearing of boat transect (°)	170 °
	Lateral distance from waters edge to 75cm depth (m)	6 m
	Notes:	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	J1182823189	J1180923261	J1181623218	J1185423232
Section 2	J1180423389	J1189423402	J1184023402	J1184723383
Section 3	J1194423168	J1189723162	J1192823145	J1190123220

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	4272	4273	4276
Section 2	3341	3342	3358
Section 3	4280	4281	4282

3.36. Nabrickboy Lough (LA Sh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Survey Date	06 August 2014
NI Lake Number:	1635
WBID:	50408
County:	Fermanagh
Grid reference:	H035503
OS Grid reference (X,Y):	203539,350274
Shoreline development index:	1.538
Surface area (ha.):	2.3
Maximum recorded depth (m):	5.5

Table 186 Condition Assessment Summary Table for Nabrickboy Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓?	2 characteristic species present: *L. uniflora,* and *L. dortmanna*
	Mesotrophic: ≥ 8 characteristic species	**X**	5 characteristic species present: *L. uniflora,* and *L. dortmanna, P. alpinus, P. praelongus* & *S. angustifolium*

Attribute	Target	Status	Comment
	No loss of characteristic species	X	Loss of 2 characteristic species (*I. lacustris* & *M. alterniflorum*) since the NILS survey.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓ ✓	83% of vegetated sample spots comply for oligotrophic species. 83% of vegetated sample spots comply for mesotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	X	*E. canadensis* present in 26.1% of vegetated sample plots.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Small amount (<10%) of filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Around most of the lough emergent vegetation is sparse. Where it occurs it consists of *C. paniculata, J. acutiflorus* & *P. australis*. *L. uniflora* abundant between 0 – 0.75 m. *L. dortmanna* present between 0.5 – 0.8 m. *P. berchtoldii* and *P. alpinus* each present in one submerged sample plot at 0.25 m and 0.5 m respectively. *U. vulgaris agg.* present at 0.5 – 1.4 m. *C. virgata* present at 2 submerged sample plots at >0.75 m and 1.2 m.
	Maximum depth distribution should be maintained	✓	Z_{max} = 5.5 m, Z_s = 0.84 m, Z_v = 1.4 m.
	At least the present structure should be maintained	✓**?**	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1} Mesotrophic = 20 µgl^{-1}	 X ✓	TP = 17 µgl^{-1} (range 15-19) & TN = 0.68 mgl^{-1} (May '14 – Feb '15).
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 7.06 (range = 6.9 – 7.3).
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	✓	Waters well oxygenated: DO >8.15 mgl^{-1} >3 m. No clear thermocline
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture boulders and cobbles with occasional silt and sand.
Sediment load	Natural sediment load maintained	✓	The lough sits within a catchment consisting of forestry and raised bog. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	
	Minimal negative impacts and no fish farming	✓?	Causeway crosses the lough, essentially creating 2 separate loughs.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 2.3 ha, with no loss of extent of open water.

Macrophyte community composition

Nabrickboy Lough has a moderately diverse assemblage of macrophyte taxa and is classified under the H3130: Oligotrophic to mesotrophic standing waters. Given the presence of a number of characteristic mesotrophic species (*Littorella uniflora, Lobelia dortmanna, Potamogeton alpinus, Potamogeton praelongus and Sparganium angustifolium*) and other taxa which are associated with higher nutrients (*Callitriche sp.* and *Potamogeton berchtoldii*), it is deemed that Nabrickboy lough is mesotrophic rather than oligotrophic. This survey recorded 10 aquatic species, 5 of which were characteristic mesotrophic species (JNCC 2015). Three species of Potamogeton were recorded (*P. alpinus, P. berchtoldii, P. praelongus*). One Charophyte species was recorded (*Chara virgata*). Other aquatic taxa include: *Callitriche sp., Elodea canadensis* and *Utricularia vulgaris agg*. Emergent species present include; *Angelica sylvestris, Carex paniculata, Juncus acutiflorus, Juncus effusus* and *Phragmites australis*. A comprehensive taxa list is given in Table 190.

The NI lake survey (NILS) recorded a somewhat similar set of species at Nabrickboy Lough as the current survey, although there are some notable absences from the current survey when compared to the NILS surveys. Species recorded in both surveys are: *L. uniflora, L. dortmanna, P. alpinus, P. praelongus, Sparganium angustifolium* and *C. virgata*. Additional species recorded in the NILS survey were: *Isoetes lacustris, Myriophyllum alterniflorum* and *Potamogeton polygonifolius*. In the current survey they was some difficulty in surveying >75 m depth. The water was peaty and difficult to see the bottom of the lake at this depth. Also, a grab sampler was not available at the time of the survey and the rake proved inefficient as it consistently got caught on the cobbles and boulders. There is a possibility that I. lacustris was present in this zone but was not detected using the survey methods. *E. canadensis* was recorded in the current survey but was absent in the NILS survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are higher than those calculated from the NILS 1988 data, indicative of nutrient enrichment.

Table 187 Aquatic macrophyte community composition for Nabrickboy Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=23)***
Callitriche sp.	-	-	-	-	-	13
Chara virgata	8.5	7.69	+	8.5	7.69	8.7
Elodea canadensis	-	-	-	8.5	7.95	26.1
Littorella uniflora	**6.7**	**4.23**	**4**	**6.7**	**4.23**	**78.3**
Lobelia dortmanna	**5**	**3.08**	**3**	**5**	**3.08**	**34.8**
Myriophyllum alterniflorum	5.5	4.23	2	-	-	-
Potamogeton alpinus	**5.5**	**5.38**	**2**	**5.5**	**5.38**	**4.3**
Potamogeton berchtoldii	-	-	-	7.3	7.69	4.3
Potamogeton polygonifolius	3	3.08	1	-	-	-
Potamogeton praelongus	**7.3**	**5.38**	**2**	**7.3**	**5.38**	**+**
Sparganium angustifolium	**3**	**4.23**	**2**	**3**	**4.23**	**+**
Utricularia vulgaris agg.	-	-	-	5.5	4.23	43.5
Average score	**5.6**	**5.2**		**6.4**	**5.5**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Negative indicator species

E. canadensis was recorded in 26.1% of all survey plots. In the NILS 1980's survey of this site *E. canadensis* was not recorded, so its presence perhaps represents an introduction since the NILS survey. Given the methodological differences of both surveys it's hard to make comparisons but when present *E. canadensis* is usually conspicuous so it is unlikely that it was missed from the NILS survey if present. CSM guidance (JNCC 2015) stipulates that there should be less than 5% cover of either *E. canadensis* or *E. nuttallii* if recently introduced to a site.

Macrophyte community structure

Nabrickboy Lough sits within a catchment which is dominated by coniferous forest plantations on raised peat bog. At the time of the survey there was evidence of recent tree felling close to the Lough.

Around most of the lough emergent vegetation is sparse. Where it occurs it consisted of *Carex paniculata, Juncus acutiflorus & Phragmites australis*. *Littorella uniflora* was abundant between 0 – 0.75 m. *Lobelia dortmanna* present between 0.5 – 0.8 m. *Potamogeton berchtoldii* and *Potamogeton alpinus* each present in one submerged sample plot at 0.25 m and 0.5 m respectively. *Utricularia vulgaris agg*. present at 0.5 – 1.4 m. *Chara virgata* present at 2 submerged sample plots at >0.75 m and 1.2 m. Both *Sparganium angustifolium* and *Potamogeton praelongus* were not recorded within the transect area.

Water quality

Table 188 Water chemistry data for Nabrickboy Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	15	17	18	19	**17**	26
SRP	2	<1	3	5	**<3**	9
TN	0.63	0.65	0.68	0.74	**0.68**	0.46
TON	0.095	0.007	0.073	0.125	**0.075**	-
Nitrite	0.004	<0.001	<0.001	<0.001	**<0.002**	-
Chl *a*	3.85	2.42	3.41	1.10	**2.70**	3.53
DOC	12.8	14.1	14.9	15.8	**14.40**	-
pH	7.25	7.12	7.07	6.87	**7.06**	6.82
Alk	14	19	19	13	**16.25**	5.15
Cond	84	86	84	88	**86**	118
Ca^{2+}	5.39	6.66	6.72	5.01	**5.9**	5.42
Mg^{2+}	1.89	2.08	2	1.95	**1.98**	2.28
Na^{+}	9.19	8.77	8.82	10.1	**9.22**	10.6
K^{+}	0.843	0.777	0.807	0.894	**0.83**	0
Cl^{-}	17.7	16	16	20.1	**17.45**	24.41
SO_4^{2-}	<10	3.51	3.54	3.96	**<5.25**	8.28

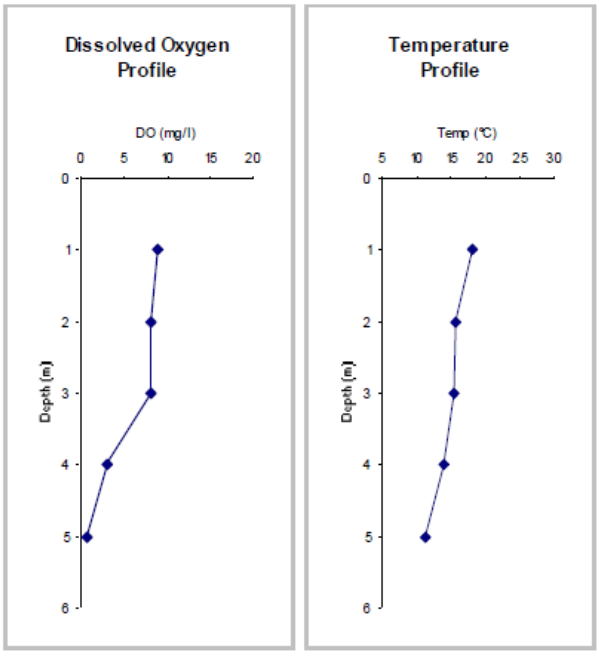
Figure 42 Dissolved oxygen and temperature profile for Nabrickboy Lough (06/08/2014)

Dissolved Oxygen Profile

GPS Location	H0364750313
Maximum Depth (m)	5.5 m
Secchi Depth (cm)	84 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
1	8.91	18
2	8.23	15.7
3	8.15	15.5
4	3.03	14.1
5	0.85	11.4



Nabrickboy Lough is a shallow (Z_{max} recorded = 5.5 m) mesotrophic lake with an

annual mean TP (17 μgl^{-1}) which is slightly below guideline levels for very shallow mesotrophic loughs (20 μgl^{-1}, JNCC 2015) and classifies it as “favourable” with respect to trophic status. Filamentous algal cover was low, as was Chlorophyll a amounts. The water column was well oxygenated (> 7.8 mgl^{-1}) above 3 m depth. (Figure 42).

Hydrology
The hydrological regime at the site appears natural.

Lake substrate
The lake basin is predominantly silt and sand.

Sediment load
Nabrickboy Lough is surrounded by forestry and blanket peat bog. Forest operations, such as clearfell, within a catchment can add to the sediment load of a lake. There was evidence of recent forest operations within the catchment which can add to the sediment load. Limited evidence of this was apparent at the time of the survey however.

Indicators of local distinctiveness
None present.

Summary
Nabrickboy Lough is a moderate example of a mesotrophic lake, with some characteristic flora and water chemistry. The current survey recorded 5 characteristic species which were present in 83% of all sample plots. There is some change in the macrophyte flora compared to the NILS 1988 survey with *M. alterniflorum* and *I. lacustris* not present in the current survey, although the absence of *I. lacustris* could reflect methodological limitations. The dominant land cover is coniferous forest plantations which may have had an impact on the aquatic flora. A forestry causeway crosses the lough creating 2 separate water basins, its unknown if this causeway was built before the previous NILS survey. TP levels were just within CSM guideline levels (JNCC 2015) and both filamentous algal cover and chlorophyll a levels were low. Despite the lough showing some characteristic features of a mesotrophic lake, the number of characteristic species is lower than the target level set in the CSM guidance (JNCC 2015). Given the low number of characteristic species, Nabrickboy Lough is classed as being in an **Unfavourable** condition.

Table 189 Nabrickboy Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Nabrickboy Lough NI Lake 1635	**Unfavourable**	Less that the target number of characteristic species for a mesotrophic lake. *E. canadensis present*	A moderate diversity of macrophyte taxa present with 5 characteristic mesotrophic species present. TP concentrations lie just within the upper limit for this lough type.

Species list

Table 190 List of all plant species recorded at Nabrickboy Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Phragmites australis	F
Juncus acutiflorus	O
Salix sp.	O
Calluna vulgaris	O
Juncus effusus	O
Carex sp.	R
Succisa pratensis	R
Sparganium angustifolium	R
Ranunculus flammula	R
Angelica sylvestris	R
Juncus bulbosus	R
Myrica gale	R
Carex paniculata	R
Submerged & floating species	**% Frequency (n = 23)**
Callitriche sp.	13
Chara virgata	9
Elodea canadensis	26
Littorella uniflora	**78**
Lobelia dortmanna	**35**
Potamogeton alpinus	**4**
Potamogeton berchtoldii	4
Potamogeton praelongus	**+**
Sparganium angustifolium	**+**
Utricularia vulgaris agg.	44

Survey data

Site Condition Assessment: Nabrickboy Lough (06/08/2014)

Lake Details		**Survey Details**		
Lake Name	Nabrickboy Lough	Survey Date	06/08/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	1	out of
Grid Ref (centre)	H035503	Wader Surveys	1	1
WBID / NI No.	50408 / 1635	Boat Surveys	1	sections

Site Notes:

Survey Notes:
Lake bed cobble and boulder. Some uncertainty over >75cm. Rake picked up limited material but this may be due to boulders. Water too peaty to see bottom with Bathyscope.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	140 cm
	Compass bearing of boat transect (°)	156 °
	Lateral distance from waters edge to 75cm depth (m)	2 m
	Notes: Lake bed cobble and boulder difficult with rake.	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H0355950219	H0365650261	H0361650234	H0361050242

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0189	0191	0192

3.37. Innaghachola Lough (LA VSh)

Annex 1 type: H3130: Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea

Survey Date	16 June 2015
NI Lake Number:	1650
WBID:	50591
County:	Tyrone
Grid reference:	H053839
OS Grid reference (X,Y):	205321,383902
Shoreline development index:	1.159
Surface area (ha.):	1.4
Maximum recorded depth (m):	0.9

Table 191 Condition Assessment Summary Table for Innaghachola Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	Oligotrophic: ≥ 3 characteristic *Littorelletea* species (≥ 2 if valid reasons suggest otherwise)	✓	5 characteristic species present: *L. uniflora, L. dortmanna, I. lacustris, S. angustifolium & U. minor.*
	Mesotrophic: ≥ 3 characteristic *Potamogeton* spp. and ≥ 8 other characteristic species	**X**	5 characteristic species present: including the above 3 species plus *S. angustifolium* & *U. minor*

Attribute	Target	Status	Comment
	No loss of characteristic species	✓	No loss of characteristic species since the NILS survey. One additional species recorded in this survey: *I. lacustris*.
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	**X**	43% of vegetated sample spots comply for mesotrophic species. 43% % of vegetated sample spots comply for oligotrophic species.
Negative indicator species	Non-native species absent or present at low frequency	✓	None present
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Small amount (<10%) of filamentous algae recorded.
Macrophyte community structure	Characteristic vegetation zones should be present	✓	This shallow lough sits within a large expanse of blanket bog on the border with the RoI. The surrounding vegetation consists predominantly of wet *C. vulgaris/Molinia* heath. Sparse emergent vegetaion with *C. rostrata, C. limosa* & *E. fluviatile* & occasional *M. trifoliata*. *L. uniflora* and *L. dortmanna* present up to 0.5m depth. *I. lacustris* occupying slightly deeper water at 0.75m. *P. natans* common in section 1 up to 0.75 m depth. *Sphagnum sp.* present at all depths. *J. bulbosus* sparse. *U. minor* only recorded at 0.25m depth. .
	Maximum depth distribution should be maintained	✓	Z_{max} = 0.9 m, Z_s = 0.9m, Z_v = 0.8 m.
	At least the present structure should be maintained	✓	No comparable data.
Water quality	Stable nutrients levels: TP target / limit: Oligotrophic = 10 µgl^{-1}	✓	TP = 4.45 µgl^{-1} (range 1.2-7.9) & TN = 0.38 mgl^{-1} (Apr '14 – Feb '15).
	Mesotrophic = 20 µgl-1	✓	
	Stable pH values: pH ~ 5.5 – circumneutral	✓	pH = 4.95 (range = 4.5 – 6.5).
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	Site shallow. Waters oxygenated throughout water column DO ~9 mgl^{-1}

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	✓	None present
Hydrology	Natural hydrological regime	✓	Natural.
Lake substrate	Natural shoreline maintained	✓	Natural.
	Natural and characteristic substrate maintained	✓	A mixture of silt, peat, pebble and cobble substrates.
Sediment load	Natural sediment load maintained	✓?	The lough sits within a large area of blanket bog. Forestry within the catcment. Sediment load appears natural.
Indicators of local distinctiveness	Distinctive elements maintained	✓	
	Minimal negative impacts and no fish farming	✓?	Forest operations have potential to cause negative impacts. Wind farm nearby.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.4 ha, with no loss of extent of open water.

Macrophyte community composition

Table 192 Aquatic macrophyte community composition for Innaghachola Lough, including trophic scores

	1990 (NILS)			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=40)***
Callitriche sp.	-	-	2	-	-	-
Isoetes lacustris	-	-	**-**	**5.0**	**4.23**	**7.5**
Juncus bulbosus	3.7	3.08	4	5.3	3.08	17.5
Littorella uniflora	**6.7**	**4.23**	3	**6.7**	**4.23**	**25**
Liverworts aquatic	-	-	1	-	-	10
Lobelia dortmanna	**5.0**	**3.08**	4	**5.0**	**3.08**	**22.5**
Menyanthes trifoliata	5.3	-	-	5.3	-	5
Potamogeton natans	**6.7**	4.23	3	**6.7**	4.23	25
Potamogeton polygonifolius	**3.0**	3.08	1	**3.0**	3.08	+
Sparganium angustifolium	-	-	-	**3.0**	4.23	**5**
Sphagnum sp.	**3.7**	1.54	2	**3.7**	1.54	60
Utricularia minor	**4.0**	**3.08**	3	**4.0**	**3.08**	**7.5**
Average score	**4.8**	**3.19**		**4.8**	**3.42**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Innaghachola Lough is a shallow peaty lough that sits in a large expanse of upland blanket bog. The flora present is characteristic of an oligotrophic upland lough with 5 characteristic species present: *Isoetes lacustris, Littorella uniflora* and *Lobelia dortmanna, Sparganium angustifolium* and *Utricularia minor* . Other taxa include *Juncus bulbosus, Potamogeton natans and Sphagnum sp.* The lough was last surveyed in 1990 as part of the NILS programme. The taxa recorded in both surveys are similar although *I. lacustris* and *S. angustifolium were* not recorded in the NILS survey. Both species are present at low abundance so could have been missed in the NILS survey, which given the different methodologies used is not surprising. All other taxa recorded are the same for both the NILS and the current survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated form the NILS 1988 data, suggesting that the tropic status is stable

Negative indicator species

No negative indicator species present. The lough is isolated and unlikely to appeal for angling or other recreation so the site is at low risk of any future invasions from non-native species.

Macrophyte community structure

This shallow lough sits within a large expanse of blanket bog on the border with the RoI. The surrounding vegetation consists predominantly of wet *C. vulgaris/Molinia* heath. Emergent vegetation was sparse with occasional patches of *Carex rostrata* and *Carex limosa* with a denser patch of *Equisetum fluviatile* in Section 2 and occasional *Menyanthes trifoliata*. *Littorella uniflora* and *Lobelia dortmanna* present up to 0.5m depth. *Isoetes lacustris* occupies slightly deeper water at 0.75m. *Potamogeton natans* common in section 1 up to 0.75 m depth. *Sphagnum sp.* present at all depths. *Juncus bulbosus* was recorded sporadically at various depths. *Utricularia minor* only recorded at 0.25m depth. *Juncus acutiflorus* was recorded from the open water in the boat survey in section 1, reflecting the shallow nature of the lake.

Water quality

The water chemistry of Innaghachola Lough is typical of oligo-mesotrophic lakes, having brown, nutrient poor and base poor water (Table 193). Total phosphorus concentrations are below levels set out in the both the 2005 and 2015 CSM guidance and therefore meet ‘favourable’ status (JNCC 2005 & 2015). Small amount of filamentous algae were recorded (<10%) and chlorophyll *a* concentrations are low, although spring and summer values are higher due to increased biological activity. Total nitrogen is also low. The lough is therefore considered to be in a ‘favourable’ status with respect to trophic status. The lough is very shallow and showed no stratification. The water was well oxygenated at the time of the survey (Figure 43).

Hydrology

The lough sits within a raised peat bog catchment on the NI/ROI border. A young forestry plantation lies to the north of the lough on the RoI side. There is a small outflow on the western side of the lough. The current hydrology appears stable.

Table 193 Water chemistry data for Innaghachola Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1988
TP	6.7	1.2	7.9	2	**4.45**	17
SRP	<1	<1	<1	<1	**<1**	9
TN	0.38	0.55	0.49	0.11	**0.38**	0.3
TON	<0.005	0.006	0.007	<0.005	**<0.006**	-
Nitrite	<0.001	<0.001	<0.001	<0.001	**<0.001**	-
Chl *a*	4.47	3.67	0.99	0.07	**2.3**	1.19
DOC	5.28	14.4	9.34	2.21	**7.81**	-
pH	6.45	5.99	5.07	4.46	**4.95**	6.53
Alk	<5.00	6	<5.00	<5.00	**<5.25**	-
Cond	48	39	34	108	**57**	65
Ca^{2+}	<1	<1	0.322	0.852	**<0.79**	1.6
Mg^{2+}	0.90	0.99	0.49	2.02	**1.10**	0.85
Na^{+}	7.74	5.83	4.55	13.3	**7.86**	6.4
K^{+}	0.15	<0.1	0.12	0.37	**<0.185**	0.15
Cl^{-}	13	9	8	25.4	**13.85**	11.7
SO_4^{2-}	<10	1.58	1.79	4.46	**<4.46**	3.38

Figure 43 Dissolved oxygen and temperature profile for Innaghachola Lough (16/06/2015)

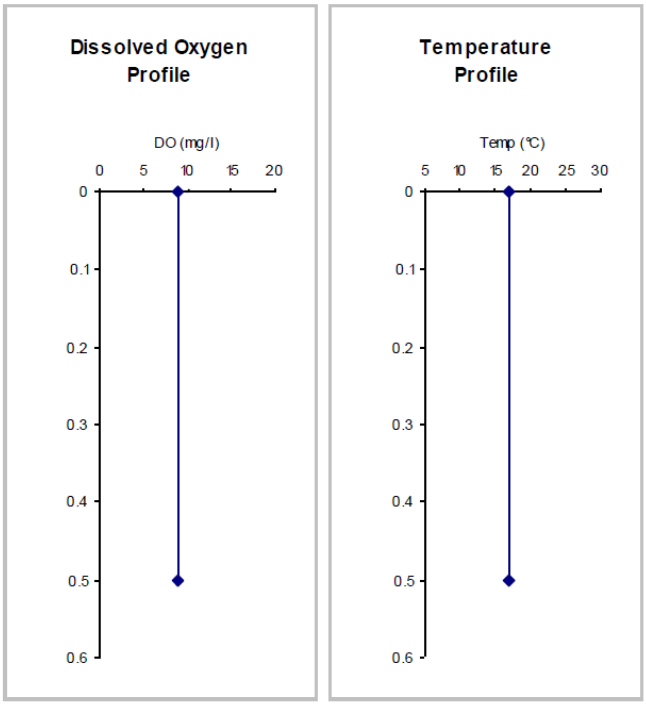
Site Condition Assesment: Innaghachola Lough (16/06/2015)

Dissolved Oxygen Profile

GPS Location	H0537683837
Maximum Depth (m)	0.9 m
Secchi Depth (cm)	-

Notes: Secchi . 90 cm

Depth (m)	DO (mg/l)	Temp (°C)
0	9.01	16.9
0.5	9.02	16.9



Lake substrate

The lake basin is predominantly silty with occasional boulders and peat substrates.

Sediment load

No evidence of increased sediment loads was noted from the catchment.

Indicators of local distinctiveness

None noted.

Summary

Innaghachola Lough is a small, shallow, upland oligotrophic lake. It is surrounded by blanket peat bog, forestry and a nearby wind farm. The impact of forestry and the wind farm appears limited as the lough meets favourable status with respect to trophic status and no other negative impacts were observed. Five characteristic species were recorded (*L. uniflora, L. dortmanna*, *I. lacustris, S. angustifolium and U. minor*). The taxa present were similar to those found in the 1990 NILS survey, with the addition of *I. lacustris* in this survey, suggesting that the site is stable. The cover of characteristic species at Innaghochola Lough is 43% which is lower than the CSM guideline level of 60% (JNCC 2015). The reason for this is unclear but it is unlikely to be related to water chemistry as all parameters are favourable. The site is shallow and exposed at ~300m above sea level, therefore wind and wave action is likely to cause continual disturbance of the lake bed which may limit Isoetid growth. Another possible cause of the low cover value for characteristic species was due to the relatively high cover of *Sphagnum sp*. This was unrooted in many places, therefore the recording of this taxa has artificially inflated the total plant cover thus reducing the percentage share of the Isoetid species. Additionally, the fact that the taxa list is very similar to the NILS survey suggests that there has been no deterioration at the site and is therefore stable.

Given the characteristic water chemistry and stable flora this report concludes that Innaghachola Lough is in a '**favourable**' condition. However the cover of characteristic species is lower than guideline levels. Also the presence of the forestry plantation close to the lough shore has the potential to impact the lough if future forestry operations are undertaken such as felling and re-planting. Therefore the Lough is placed '**at risk**'.

Table 194 Innaghachola Lough: Overview

Water Body	Status	Reason(s) for At risk	Comments
Innaghachola Lough NI Lake 1650	**Favourable, at risk**	Below guideline cover of characteristic species. Forestry nearby.	Site has characteristic water chemistry and 5 characteristic species present: *L. uniflora, L. dortmanna, I .lacustris, S. angustifolium and U. minor. I. lacustris* recorded at the site for the first time.

Species list

Table 195 List of all plant species recorded at Innaghachola Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Molinia caerulea	F
Calluna vulgaris	F
Narthecium ossifragum	O
Mosses unid	O
Trichophorum cespitosum subsp.	O
Carex limosa	O
Carex rostrata	O
Eriophorum vaginatum	R
Juncus articulatus	R
Carex panicea	R
Carex nigra	R
Equisetum fluviatile	R
Succisa pratensis	R
Anthoxanthum odoratum	R
Potamogeton polygonifolius	R
Polygala serpyllifolia	R
Carex echinata	R
Drosera rotundifolia	R
Erica tetralix	R
Eriophorum angustifolium	R
Juncus acutiflorus	R
Pellia epiphylla	R
Pinguicula vulgaris	R
Juncus effusus	R
Potentilla erecta	R
Ranunculus flammula	R
Viola palustris	R
Juncus squarrosus	R
Juncus conglomeratus	R
Submerged & floating species	**% Frequency (n = 40)**
Isoetes lacustris	8
Juncus bulbosus	18
Littorella uniflora	25
Liverworts aquatic	10
Lobelia dortmana	23
Menyanthes trifoliata	5
Potamogeton natans	25
Sparganium angustifolium	5
Sphagnum sp.	60
Utricularia minor	8

Survey data

Site Condition Assessment: Innaghachola Lough (16/06/2015)

Lake Details		**Survey Details**		
Lake Name	Innaghachola Lough	Survey Date	16/06/2015	
SSSI Name		Surveyors	BG & MST	
SAC Name		Shore Surveys	2	out of
Grid Ref	H053839	Wader Surveys	2	2
WBID / NI No.	50591 / 1650	Boat Surveys	2	sections

Site Notes:
Most of lough is in the RoI. Only small area of the SE is in NI. Access via Wind farm on RoI side

.

Survey Notes:
Shallow site <1.0m. Young conifer plantation to N and NE of site - rest of catchment is upland moorland. Wind farm to SW of site

.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	80 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	12 m
		Notes: PLANTS TO MAX DEPTH	
Section	**2**	Maximum depth of colonisation (cm)	80 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	7 m
		Notes: NO PLANTS RECORDED IN OPEN WATER	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0532283845	H0527483924	H0528283875	H0534183893
Section	**2**	H0535283824	H0538883888	H0537783852	H0537683837

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3244	3245	3246
Section	**2**	3248	3249	3250

3.38. Legalough Lough (HA VSh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	18 June 2015
NI Lake Number:	1667
WBID:	50501
County:	Fermanagh
Grid reference:	H088346
OS Grid reference (X,Y):	208830,334610
Shoreline development index:	1.086
Surface area (ha.):	1.8
Maximum recorded depth (m):	5.5

Table 196 Condition Assessment Summary Table for Legalough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	2 present: *Chara hispida* and *Chara virgata*.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	5% of vegetated sample spots comply (15% wader, 0% boat).
	Negative indicator species absent or at low frequency	✓	None present.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	✓**?**	None present
	Filamentous Algae (non-Chara): <20% of points scoring '3'	✓	None recorded
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Species rich emergent zones (*P. australis, S. lacustris, S. erectum* and *M. trifoliata*). Margins shelve steeply to > 2m from 0.50 – 0.75 m. *P. alpinus* abundant amongst clearings in the reeds and on a steeply shelving bank beyond the reeds. Submerged beds of *Chara* spp. in S2 amongst reeds, only present in the shallows <0.5. *Chara* beds present, but not covering 50% of photic zone. No *Chara* in S1
	Maximum depth distribution should be maintained	✓	Z_{max} = 5.5 m, Z_{s} = 3.1 m, Z_{v} = 2.3 m.
	At least the present structure should be maintained	✓	No comparable data .
Water quality	Stable nutrients levels: TP target / limit = 15 μgl^{-1}	✓**?**	Based on 4 samples Apr 14 – Feb 15. TP = 15.5 μgl^{-1} (range 11 – 20.6 μgl^{-1}) & TN = 0.62 mgl^{-1}
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 7.94 (range = 7.8 – 8.1)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	✓	Waters were well oxygenated to 3 m (>8.56 mgl^{-1}), below which levels rapidly dropped off to < 0.5 mgl^{-1}. Mean DO below the thermocline (below 3 m) 0.33 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	No excessive cyanobacterial blooms or filamentous algal growth observed.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change. Surface sediments exhibit marl deposits.
Sediment load	Natural sediment load maintained	✓	Minor disturbance from cattle poaching, but no evidence of significantly increased sediment loads
Indicators of local distinctiveness	Distinctive elements maintained	✓**?**	*C. hispida* is present, although uncommon in the site.
	Minimal negative impacts	✓	Lough margin is fenced off from cattle.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.8 ha, with no loss of extent of open water.

Macrophyte community composition

Table 197 Aquatic macrophyte community composition for Legalough, including trophic scores.

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=55)***
Chara hispida	**-**	**-**	**-**	**8.5**	**7.69**	**3.6**
Chara virgata	**-**	**-**	-	**8.5**	**7.69**	**3.6**
Fontinalis antipyretica	6.3	5.38	4	6.3	5.38	27.3
Lemna trisulca	-	-	-	10	8.85	1.8
Menyanthes trifoliata	-	-	-	5.3	-	10.9
Nuphar lutea	8.5	6.92	3	8.5	6.92	47.3
Potamogeton alpinus	5.5	5.38	4	5.5	5.38	29.1
Potamogeton natans	6.7	4.23	4	6.7	4.23	54.5
Average score	**6.8**	**5.48**		**7.4**	**6.59**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Legalough sits within a an area of limestone geology on the border with the Republic of Ireland. The lake is circular in shape and is steeply shelving on all sides. The submerged aquatic flora is limited with two species of submerged *Chara*: *C. hispida* and *C. virgata* both present in the margins. The dominant submerged macrophyte was *Potamogeton alpinus* followed by *Fontinalis antipyretica*. *Nuphar lutea* and *Potamogeton natans* were common around the lough occupying a thin fringe. The NILS survey recorded the same taxa as the current survey apart from the absence of *Lemna trisulca* and Charophytes. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) has increased since the NILS survey, which can be attributed to the presence of Charophytes and *L. trisulca* in the current survey. This could reflect a trophic shift, although it is also possible that the charophytes may have been missed in the NILS survey as they only occupy a small area of the lough and different methodologies were used in each survey.

Negative indicator species

None present. This is an isolated lake used occasionally by anglers. Good biosecurity should be encouraged at this site to prevent colonisation by non-native species.

Macrophyte community structure

Legalough has a relatively well developed hydrosere around much of its margin with emergent reed beds dominated by *Schoenoplectus lacustris* with *Phragmites australis, Carex rostrata* and *Sparganium erectum* all common. *Equisetum fluviatile* and *Menyanthes trifoliata* are also present within the emergent zone. Section 1, on the west side of the lough comprised of *S. lacustris* dominated reed bed, with *P. australis* and *M. trifoliata* to approximately 0.75 m, beyond which it shelved rather steeply to 3 m with only *Nuphar lutea* and *Potamogeton natans* recorded to a maximum depth of 2.8 m; there were no charophytes recorded within this section. Section 2, on the southeast shore, had a similar *S. lacustris* dominated reed bed, although some clearings in the reed bed consisted of peat depressions which were filled with *P. alpinus* and both *Chara* species at ~ 0.5m depth. Beyond 0.75 m the lake shelved steeply to ~3 m. Here *P. alpinus* grew along with *N. lutea* and *P. natans*. Beyond 3 m depth no plants grew to the maximum lake depth of 5.5 m. Marl lakes in good condition would be expected to support charophytes within this zone. At the time of the survey the water clarity seemed good enough to support charophytes at this depth. However subsequent water quality monitoring in mid summer and autumn both recorded turbid water.

Water quality

Legalough is currently classified as H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*. Given the water chemistry (High alkalinity and pH) and the fact that the lough sits within an area of chalk grassland and has several *Chara* species the Lough fits better with the hard water type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. The water chemistry of Legalough is typical of hard oligo-mesotrophic lakes and ponds, having relatively clear base-rich water (Table 253). The mean total phosphorus concentrations are just above the target limit set out in the 2015 CSM guidelines for this lake type (15 μgl^{-1} JNCC 2015). The lough is therefore considered to be in an 'unfavourable' condition with respect to trophic status using 2015 CSM guidelines ('favourable' under the original 2005 CSM guidelines). Chl *a* concentrations were relatively low during the sampling period. In summer and autumn it was noted that the water was slightly turbid and green.

Total nitrogen was below the 1.5 mgl^{-1} set out in the CSM guidance (JNCC 2015) and total oxidised nitrogen relatively low. The lake was stratified in July with the upper 3 m of the water column being well oxygenated (> 8.5 mgl^{-1}), declining rapidly to <0.5 mgl^{-1} below this at 5.0 m depth. (Figure 55).

Hydrology

The lough sits within an area of limestone geology. There is a small inflow stream on the western side of the lough flowing through an area of improved grassland. The hydrology appears unaltered and natural.

Lake substrate

The lake basin is predominantly silty with marginal substrates comprising of organic sediments and root mats within the reed beds. Some areas of eroded peat. Marl deposits were noted on both plants and on the sediment surface, but these were relatively light.

Sediment load

The lake is surrounded by fencing so cattle and sheep cannot access the lake margin. No evidence of increased sediment loads was noted from the catchment.

Indicators of local distinctiveness

None recorded

Table 198 Water chemistry data for Legalough

	Apr ’14	Aug '14	Nov '14	Feb ’15	Mean	1988
TP	10.9	19.4	20.6	11	15.5	24
SRP	1.4	<1	3.1	1.3	<1.7	4
TN	0.36	0.64	0.95	0.52	0.62	0.56
TON	0.027	0.034	0.254	0.239	0.139	-
Nitrite	0.002	0.0013	0.0087	<0.001	<0.003	-
Chl *a*	5.39	8.36	2.64	3.08	4.87	11.96
DOC	4.33	5.84	7.6	4.03	5.45	-
pH	8.1	8.01	7.78	7.94	7.94	8.18
Alk	122	154	138	100	129	77.6
Cond	247	296	273	243	265	320
Ca^{2+}	48.7	59.7	50.4	41.7	50.1	52.6
Mg^{2+}	1.81	2.6	2.16	1.7	2.07	2
Na^{+}	5.9	5.83	5.96	8.44	6.53	8.85
K^{+}	0.577	0.633	0.817	0.828	0.714	0.4
Cl^{-}	9.7	8.4	11	19.2	12.1	22.8
SO_4^{2-}	<10	2.45	3.74	3.38	<4.89	5.86

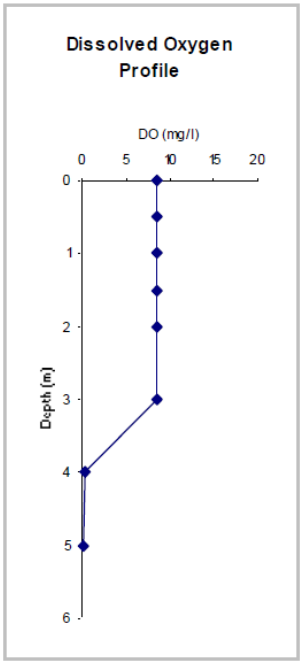
Figure 44 Dissolved oxygen and temperature profile for Legalough (05/07/2014)

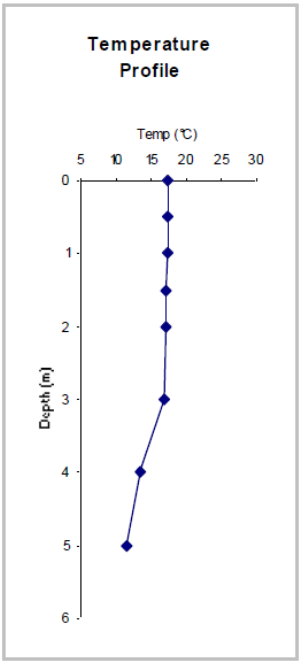
Dissolved Oxygen Profile

GPS Location	H0885434644
Maximum Depth (m)	5.5 m
Secchi Depth (cm)	310 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	8.61	17.3
0.5	8.58	17.3
1	8.52	17.3
1.5	8.56	17.2
2	8.56	17.2
3	8.56	16.9
4	0.39	13.6
5	0.27	11.6





Summary

Legalough has been reclassified from H3130: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* to H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. This reclassification is in part down to the absence of characteristic flora associated with a type H3130 lake and in part due to the water chemistry being more typical of a type H3140 lake. Also the lake sits within an area of chalk grassland and two *Chara* spp. were recorded further suggesting that this lake is of the H3140 type. The NILS survey (1988) did not record any Charophytes which may, in part, explain the classification as H3130.

TP levels are above the recently reviewed CSM guidance (JNCC 2015) but all other water chemistry values are in line with guidance levels. The site lies within a region of improved agriculture (mainly sheep grazing), and is therefore likely to receive diffuse nutrient inputs from the catchment. Although the water clarity was good at the time of the survey (Z_S = 3.1 m) the water was turbid at both the summer and autumn water sampling visit.

Despite containing some elements of the characteristic flora, Legalough falls below the expected criteria for this site type within the CSM guidance (JNCC 2015). High TP and low overall Charophyte cover result in the site being classified as being in **unfavourable condition**. Although classified as unfavourable in terms of the submerged aquatic flora, the site has good areas of marginal and emergent vegetation which are typical of this site type. Site management should focus on identifying and reducing nutrient inputs to the site.

Table 199 Legalough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Legalough NI Lake 1667	**Unfavourable**	Borderline water quality (TP) Low charophyte cover	Site assessed as H3140. Elevated TP levels and relatively low extent of *Chara* spp.

Species list

Table 200 List of all plant species recorded at Legalough

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	R
Cardamine amara	R
Carex accutiformis	R
Carex nigra	F
Carex elata	O
Carex diandra	R
Carex rostrata	F
Epilobium palustre	R
Equisetum fluviatile	R
Equisetum palustre	R
Filipendula ulmaria	O
Galium palustre	O
Iris pseudacorus	R
Juncus acutiflorus	R
Juncus effusus	F
Mentha aquatica	O
Menyanthes trifoliata	F
Myosotis laxa	R
Myosotis scorpiodes	R
Phragmites australis	F
Potentilla anserina	R
Potentilla palustris	R
Prunella vulgaris	R
Salix sp.	R
Schoenoplectus lacustris	A
Sparganium erectum	R
Veronica beccabunga	R
Valeriana officinalis	R
Submerged & floating species	**% Frequency (n = 55)**
Chara hispida	4
Chara virgata	4
Fontinalis antipyretica	27
Lemna trisulca	2
Menyanthes trifoliata	11
Nuphar lutea	47
Potamogeton alpinus	29
Potamogeton natans	55

Survey data

Site Condition Assessment: Legalough (05/07/2014)

Lake Details		Survey Details		
Lake Name	Legalough	Survey Date	05/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H088346	Wader Surveys	2	2
WBID / NI No.	50501 / 1667	Boat Surveys	2	sections

Site Notes:

Survey Notes:
Site with steep sloping sides all round surrounded by calc grassland.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	280 cm
		Compass bearing of boat transect (°)	135 °
		Lateral distance from waters edge to 75cm depth (m)	6 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	230 cm
		Compass bearing of boat transect (°)	324 °
		Lateral distance from waters edge to 75cm depth (m)	7 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0875434600	H0881034677	H0867434647	H0876734632
Section	**2**	H0891534648	H0887134558	H0888634608	H0888034613

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0189	0190	0191
Section	**2**	0193	0194	0201

3.39. Burdautien Lough (HA VSh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	30th June 2014
NI Lake Number:	202
WBID:	50567
County:	Fermanagh
Grid reference:	H495282
OS Grid reference (X,Y):	249464,328248
Shoreline development index:	1.1
Surface area (ha.):	1.5
Maximum recorded depth (m):	7.1

Table 201 Condition Assessment Summary Table for Burdautien Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	**X**	No *Chara spp.* present. 3 present when surveyed in 2006: *Chara aculeolata*, *Chara virgata* and *Chara hispida*.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	10% of vegetated sample spots comply (10% wader, 11% boat)
	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 31% of sample sites.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 31% of sample sites.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Filamentous algae recorded (2% wader, 2% boat)
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone (see Table 5)	**X**	Emergent zone dominated by *P. australis*, *S. lacustris*, *C. rostrata*, *C. mariscus* and *T. latifolia*. Lough fringed with *N. alba* and *N. lutea* (< 2.6 m) with *H. vulgaris* (1.1 – 1.3 m), *M. spicatum* (1.7 - 2.2) and *U. vulgaris* (0.75 – 1.7 m).
	Maximum depth distribution should be maintained	✓	Z_{max} = 7 m, Z_s = 2.27m, Z_v = 3 m
	At least the present structure should be maintained	**X**	Structure similar to 2006, but further loss of charophytes
Water quality	TP target / limit = 15 μgl^{-1} (JNCC 2015)	**X**	TP = 80μgl^{-1} (range 23 - 128 μgl^{-1}) & TN = 0.84 mgl^{-1} (Apr 14 – Feb 15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 7.96 (range =7.84 – 8.12)
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	**X**	Waters were well oxygenated to 2.0 m (7.8-8.92 mgl^{-1}), below which levels dropped off to < 0.85 mgl^{-1} at 3.0 m depth and below. DO <5mgl^{-1} below the thermocline.
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial or surface algal blooms.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained. Slight disturbance from cattle poaching and shore angling
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	Slight grazing pressure and poaching but there was no evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	**X?**	3 x *Chara* species lost including the nationally scarce *Chara aculeolata*. These taxa may still be present but were not recorded in 2014.
	Minimal negative impacts	**✓?**	Moderate grazing pressure from cattle and slight poaching. Some boat angling and new fishing stages

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.5 ha, with no loss of extent of open water.

Macrophyte community composition

Burdautien Lough had an excellent aquatic macrophyte assemblage in the past with at least 4 *Chara* species recorded historically, including the nationally scarce *Chara aculeolata*, *C. virgata* and *C. hispida* recorded in 2006 and *C. aspera var. curta* (*C. curta*) recorded in 1989. In 2006, charophytes were however relatively uncommon and none were recorded during the 2014 survey despite additional searches being performed after the formal survey was completed. While this does not confirm the complete loss of charophytes, it suggested if not absent they are now very rare in this site which represent a significant ecological change and deterioration of this site. The associated species *Fontinalis antipyretica* was recorded in 1989 but was not observed in 2006, but was recorded again in 2014. *Potamogeton natans* was only observed in 2006 and 2014. Charophytes aside, all other submerged and floating leaved species were recorded in all 3 surveys. There was a reduction in the mean PLEX score (Duigan 2006) when compared to 2006. This can solely be attributed to the loss of charophytes from the site.

Table 202 Aquatic macrophyte community composition for Burdautien Lough, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=27)***	**TRS**	**PLEX**	**% occurrence (n=29)***
Chara aculeolata	8.5	7.69	7	-	-	-
Chara virgata	8.5	7.69	7	-	-	-
Chara hispida	8.5	7.69	+	-	-	-
Elodea canadensis	8.5	7.95	19	8.5	7.95	31
Hippuris vulgaris	7.7	7.88	33	7.7	7.88	17
Lemna minor	9.0	8.85	4	-	-	-
Lemna trisulca	10.0	8.85	63	10.0	8.85	79
Menyanthes trifoliata	5.3	-	19	5.3	-	24
Myriophyllum spicatum	10.0	8.85	+	10.0	8.85	10
Nuphar lutea	8.5	6.92	74	8.5	6.92	66
Nymphaea alba	6.7	3.08	19	6.7	3.08	31
Potamogeton natans	6.7	4.23	+	6.7	4.23	3.4
Utricularia vulgaris agg.	5.5	4.23	30	5.5	4.23	10.3
Average score	**8.0**	**6.96**		**7.7**	**7.2**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was recorded as rare in 1989 ('1' on a scale of 1-5), was found at 19% frequency and low abundance (median value of "1" on a 1-3 scale) in the 2006 survey and was found at 31% frequency (median value of "1" on a 1-3 scale) in the present survey. This increase in abundance could just reflect inter annual variation but should be monitored in the future.

Macrophyte community structure

Burdautien Lough is bordered by reed beds that were dominated by *Phragmites australis*, *Carex rostrata*, *Schoenoplectus lacustris* and *Typha latifolia* along the southern margin. The lough was surrounded by wetland meadows and rough pasture. *Nymphaea alba* (1.30 – 2.8 m) and *Nuphar lutea* (0.25 - 2.50 m) fringed the lough with *Hippuris vulgaris* (0.75 – 1.3 m), *U. vulgaris* (0.75 – 1.7 m), *Myriophyllum spicatum* (1.70 - 1.80 m) and *Potamogeton natans* (> 0.75 m). There were no characteristic *Chara* spp. beds that are expected of this site type and despite performing additional searches no charophytes were found in 2014.

Water quality

Table 203 Water chemistry data for Burdautien Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	2006	1989
TP	29.4	23.0	128.0	130.0	**77.6**	22.0	18.0
SRP	5.3	1.0	86.7	122.0	**53.6**	n/a	2
TN	0.73	0.71	0.89	1.04	**0.84**	0.8	0.9
TON	0.005	0.005	0.0237	0.404	**<0.11**	n/a	n/a
Nitrite	0.001	0.001	0.002	0.002	**<0.002**	n/a	n/a
Chl *a*	5.39	9.24	28.05	7.63	**12.6**	9.9	5.0
DOC	9.65	10.1	9.52	9.47	**9.69**	n/a	n/a
pH	8.12	8.09	7.86	7.84	**7.96**	7.8	8.3
Alk	223	216	221	192	**213**	140	147.4
Cond	454	439	429	431	**438**	412	513
Ca^{2+}	92.2	87.3	82.8	87.4	**87.4**	69	90
Mg^{2+}	3.53	3.51	3.38	3.46	**3.47**	3.1	3.8
Na^{+}	10.1	9.29	9.01	10.3	**9.68**	6	4.5
K^{+}	1.61	1.33	2.1	2.21	**1.81**	1.4	0.04
Cl^{-}	20.5	18.4	19.1	20.4	**19.60**	7.0	12.5
SO_4^{2-}	<10	8.56	7.87	10.9	**<9.33**	14.4	9.8

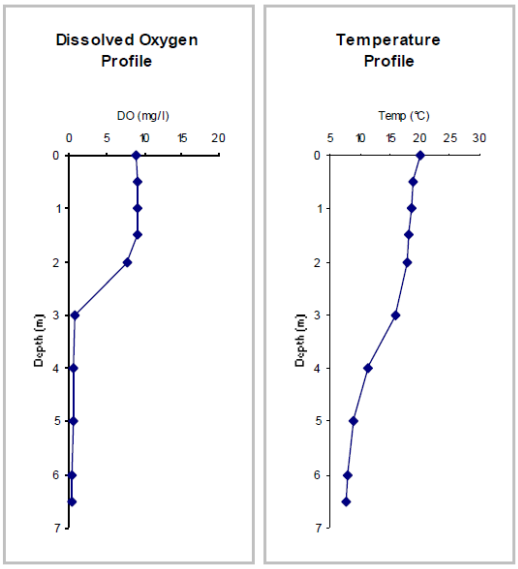
With the exception of very high total phosphorus concentrations, the water chemistry of Burdautien Lough is typical of hard oligo-mesotrophic lakes and ponds, having clear, base-rich water. In 2014 however, the annual mean TP (77.6 μgl^{-1}) was more than four times above the level set out in the CSM guidelines for this lake type (15 μgl^{-1} JNCC 2015), and greatly increased on the values in 2006 and 1989 (Table 203). The November Chl *a* value is above levels considered normal for this type of lake probably a result of elevated TP levels. The high TP also appears to have

altered the macrophyte community which is discussed below. The high TP is of major concern and classifies the lough as being in unfavourable condition with respect to trophic status. Apart form the high TP value the water chemistry data is similar to those values derived from a spot water sample taken on the 29/06/1989, and 4 samples taken in 2006/07. The upper 2.0 m of the water column was well oxygenated (> 7.8 mgl^{-1}), declining to 0.8 mgl^{-1} at 3.0 m. (Figure 1).

Figure 45 Dissolved oxygen and temperature profile for Burdautien Lough (30/06/2014)

GPS Location	as before
Maximum Depth (m)	7 m
Secchi Depth (cm)	227 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.92	20
0.5	9.17	18.8
1	9.11	18.5
1.5	9.12	18.2
2	7.8	17.8
3	0.84	16
4	0.52	11.2
5	0.51	9
6	0.46	7.9
6.5	0.48	7.7



Hydrology

The hydrological regime at the site appears natural, but given the complex carbonate geology of the Magheraveely region, it is likely to receive a significant amount of groundwater and therefore more difficult to identify the source of incoming nutrients.

Lake Substrate

The lake basin is predominantly silty with marginal substrates comprising of more organic material and dense root mats among the reed beds.

Sediment load

Disturbance to the site appears to be relatively low with only slight grazing pressure noted on the shore and light cattle poaching. There was no evidence of increased sediment loads to the lough.

Indicators of local distinctiveness

The nationally scarce *Chara aculeolata* (Stewart, 2004) was present at the site in 2006, although it wasn't found in the most recent survey (2014). It is recommended that the site is re-surveyed before confirming the absence of this and other charophytes not recorded in 2014.

Summary

There were at least four species of *Chara* recorded historically at Burdautien Lough, including the nationally scarce *Chara aculeolata.* However no charophytes were recorded in the most recent survey and even in the 2006 survey the extent of

charophyte beds was limited to less than 10% of the photic zone. Although the site exhibits water chemistry typical of hard oligo-mesotrophic lakes and ponds, having clear, base-rich water, the TP concentrations were well in excess of the CSM guidelines for this lake type and have increase nearly four-fold since 2006.

The high TP levels give rise for serious concern for this SAC site and the further reduction (potential loss) of *Chara* spp. is very likely to be as a direct result of elevated nutrients (Blindow 1992). Additionally the increasing abundance of *Elodea canadensis* is of concern and also likely to be attributed to the increase in nutrients.

The status of Burdautien Lough is considered to remain as **unfavourable**, but in addition it is noted as declining and as an SAC should therefore be prioritised for further investigation as to the source of the nutrient increase. While the site remains clear it stands a better chance of recovery than if it switches to an algal dominated system (Wiik *et al.* 2013).

There was no immediate evidence of enrichment within the area. The surrounding pastures are improved and have moderate grazing pressure and slight cattle poaching, but there was no evidence of increased sediment or direct nutrient inputs to the lough. The lough has a number of rural dwellings within the catchment and is used for limited boat and shore angling.

Table 204 Burdautien Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Burdautien Lough NI Lake 202	**Unfavourable (declining)**	Exceeds upper TP limit. Shows significant deterioration since last survey Loss of *Chara spp*.	Site remains clear despite very high TP concentrations. Determining the source of the nutrient pollution and putting a stop to it is a priority for this SAC site. Continuation of high nutrient inputs is likely to see significant and irreversible deterioration of the lough and loss of an Annex 1 habitat.

Species list

Table 205 List of all species recorded at Burdautien Lough in 2014

Marginal & Emergent species	**Abundance (DAFOR)**
Menyanthes trifoliata	F
Phragmites australis	F
Ranunculus lingua	O
Typha latifolia	O
Alnus glutinosa	O
Carex spicata	O
Galium palustre	O
Juncus acutiflorus	O
Schoenoplectus lacustris	O
Carex rostrata	O
Equisetum fluviatile	R
Mentha aquatica	R
Cicuta virosa	R
Cladium mariscus	R
Salix sp.	R
Myosotis laxa	R
Potentilla palustris	R
Hydrocotyle vulgaris	R
Lychnis flos-cuculi	R
Angelica sylvestris	R
Caltha palustris	R
Carex disticha	R
Equisetum palustre	R
Ranunculus flammula	R
Submerged & floating species	**% Frequency (n = 29)**
Chara aculeolata	-
Chara virgata	-
Chara hispida	-
Elodea canadensis	31
Hippuris vulgaris	17
Lemna minor	-
Lemna trisulca	79
Menyanthes trifoliata	24
Myriophyllum spicatum	10
Nuphar lutea	66
Nymphaea alba	31
Potamogeton natans	3
Utricularia vulgaris agg.	10

Survey data

Site Condition Assessment: Burdautien Lough (30/06/2014)

Lake Details		**Survey Details**		
Lake Name	Burdautien Lough	Survey Date	30/06/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	1	out of
Grid Ref (centre)	H495282	Wader Surveys	1	1
WBID / NI No.	50567 / 202	Boat Surveys	1	sections

Site Notes:

Survey Notes:
Fantastic marginal fen. Full of orchids. A new fishing platform being constructed when surveying.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	3 cm
		Compass bearing of boat transect (°)	204 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Additional rakes to find Chara but none found	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H4949728194	H4943828183	H4946028190	H4945528201

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0128	0129	0130

3.40. Ballaghmore Lough (HA VSh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	04 July 2014
NI Lake Number:	735
WBID:	50349
County:	Fermanagh
Grid reference:	H216438
OS Grid reference (X,Y):	221608,343790
Shoreline development index:	1.036
Surface area (ha.):	3.3
Maximum recorded depth (m):	2.2

Table 206 Condition Assessment Summary Table for Ballaghmore Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species, should be present (excluding *C. vulgaris*)	**X**	None present.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	**X**	0% of vegetated sample spots comply.
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 28% of sample sites.
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 28% of sample sites.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Minimal filamentous algae cover (3.5% wader, 0% boat)
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Species-rich wetlands border the lough, which merge into the marginal vegetation. *P. australis, S. lacustris* and *E. fluviatile* dominate the fringe to >75 cm. Other emergents include *C. virosa, S. erectum, T. latifolia, E. hirsutum*; *I. pseudacorus C. rostrata* S2 & *M. trifoliata.* Aquatic plants more limited: *N. lutea* abundant S1 & 2 (50-200 cm) interspersed by *L. trisulca* (25-220 cm). Localised bed of *P. natans* S2 (180-220 cm) with *R. aquatilis* agg. at 195 cm. *R. circinatus* also in S2 at >75 cm. *E. canadensis* frequent in both sections (50 – 220 cm). *L. minor* observed on strandline. NO *Chara* spp.
	Maximum depth distribution should be maintained	✓	Z_{max} = 2.2 m, Z_{s} = 1.40 m, Z_{v} = 2.2 m
	At least the present structure should be maintained	-	Not enough evidence from previous survey (NILS 1989).
Water quality	Stable nutrients levels: TP target / limit = 15 μgl^{-1}	**X**	TP = 98.3 μgl^{-1} (range 46.2 – 166 μgl^{-1}) & TN = 1.17 mgl^{-1} (April '14 – Feb. '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 7.6 (range = 7.3 – 8.0)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X?**	No thermocline, but mean DO was slightly below 7 mgl^{-1}. (6.5 mgl^{-1})
	No excessive growth of cyanobacteria or green algae	✓	No excessive algal growth or cyanobacterial blooms observed.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	-	Requires further investigation to determine marl precipitation.
Sediment load	Natural sediment load maintained	-	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	X	No charophytes.
	Minimal negative impacts	✓	Slight grazing pressure.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 3.3 ha, with no loss of extent of open water other than encroachment by marginal vegetation. This may have been facilitated by enrichment, but further investigation is required to determine if there has been any significant loss of open water habitat as a direct result of enrichment.

Macrophyte community composition

No charophytes were observed in Ballaghmore Lough during the 2014 survey, while in 1989 the NILS survey recorded *C. globularis*) at occasional abundance ("2" on a 1-5 scale). Therefore it is classified as 'unfavourable' with respect to the flora. *Potamogeton praelongus* and *Sparganium emersum* were recorded in 1989, but not in 2014. All other species recorded in 1989 were also recorded in 2014. Additional floating and submerged aquatic species for the recent survey include *Ranunculus aquatilis* agg, *Ranunculus circinatus, Lemna minor* and *Potamogeton natans.* Although limited in submerged and floating vegetation, the lough is exceptionally rich and diverse in emergent and marginal species, which comprises a large proportion of the overall biomass for each surveyed section. Emergent species such as *Cicuta virosa, Carex rostrata, Equisetum fluviatile, Menyanthes trifoliata, Phragmites australis* and *Schoenoplectus lacustris* were frequently recorded. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.3 and 7.66 respectively (Table 207).

Negative indicator species

Elodea canadensis was recorded at 28% frequency and where occurring was often at high abundance. This species was recorded as abundant in 1989 ("5" on a 1-5 scale), suggesting that frequency has decreased and therefore improved since the previous field survey. No other negative indicators were recorded, but in the absence of *Chara* spp. the high frequency of *L. trisulca* is indicative of enrichment.

Macrophyte community structure

Lough Ballaghmore is surrounded by a rich, diverse community of marginal and emergent vegetation, consisting of sedges, rushes and tall herbs. Frequent species include *Carex disticha, C. elata, C. nigra, C. paniculata, C. rostrata, Cicuta virosa, Sparganium erectum* and *Typha latifolia.* This is interspersed by fringing reed beds, dominated by *Phragmites australis, Equisetum fluviatile* and *Schoenoplectus lacustris.* A full list of marginal and emergent species is included in Table 210. Submerged and floating aquatic flora was rather more limited: *Nuphar lutea* was abundant in both S1 and S2 at depths between 50 – 200 cm, interspersed by *Lemna trisulca* at similar depths of 25 – 220 cm. A localised bed of *Potamogeton natans* near the western shore (S2) was recorded at depths of 180 – 220 cm. *Ranunculus*

aquatilis agg. was recorded once with rare abundance in this section, at 195 cm depth. *Ranunculus circinatus* was also in S2 in shallower waters at approximately 80 cm. *Elodea canadensis* was frequent in both sections, between 50 – 220 cm. *Lemna minor* was observed only on the strandline at Lough Ballaghmore. The current structure is more akin to shallow eutrophic waters rather than "hard water" lakes and without the characteristic charophyte community is unfavourable.

Table 207 Aquatic macrophyte community composition for Lough Ballaghmore, including trophic scores.

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=76)***
Chara globularis	**8.5**	**7.69**	**2**	**-**	**-**	**-**
Elodea canadensis	**8.5**	7.95	**5**	8.5	7.95	28
Equisetum fluviatile	-	-	-	-	-	24
Lemna minor	-	-	-	9.0	8.85	+
Lemna trisulca	10.0	8.85	5	10.0	8.85	89
Menyanthes trifoliata	-	-	-	5.3	-	8
Nuphar lutea	8.5	6.92	5	8.5	6.92	64
Potamogeton praelongus	7.3	5.38	1	-	-	-
Potamogeton natans	-	-	-	6.7	4.23	12
Ranunculus aquatilis agg.	-	-	-	8.5	7.95	1
Ranunculus circinatus	-	-	-	10.0	8.85	1
Sparganium emersum	10.0	7.50	3	-	-	-
Average score	**8.8**	**7.38**		**8.3**	**7.66**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Water quality

The water chemistry at Ballaghmore Lough is typical of hard oligo-mesotrophic lakes and ponds, having base-rich water, high pH and elevated alkalinity. Total phosphorus is however well above the level set out in the CSM guidelines for this lake type (15 μgl^{-1} JNCC 2015) and is higher than the TP concentration recorded from a spot water sample taken in 1989 (25.0 μgl^{-1}), though no firm conclusions can be drawn from these two sets of independent data as seasonal variation was not taken into account in the 1989 survey. The lough is therefore considered to be in 'unfavourable' condition with respect to trophic status. Chl *a* concentrations are generally low, although a slight peak occurred in April (10.34 μgl^{-1}) and November (6.16 μgl^{-1}). Nutrient enrichment from adjacent agricultural fields could be a possible cause for this. At the time of survey in July 2014, water clarity was recorded as slightly turbid, with light penetration reaching depths of 140 cm, significantly lower

than expected from lakes of this type. However, no excessive algal growth or cyanobacterial blooms were observed. The upper reaches of the water column (0 – 1 m) are fairly well oxygenated (8.13 – 5.91 mgl^{-1}), rapidly declining to 3.95 mgl^{-1} at the greatest depth of 1.5 m (Figure 46).

Table 208 Water chemistry data for Ballaghmore Lough

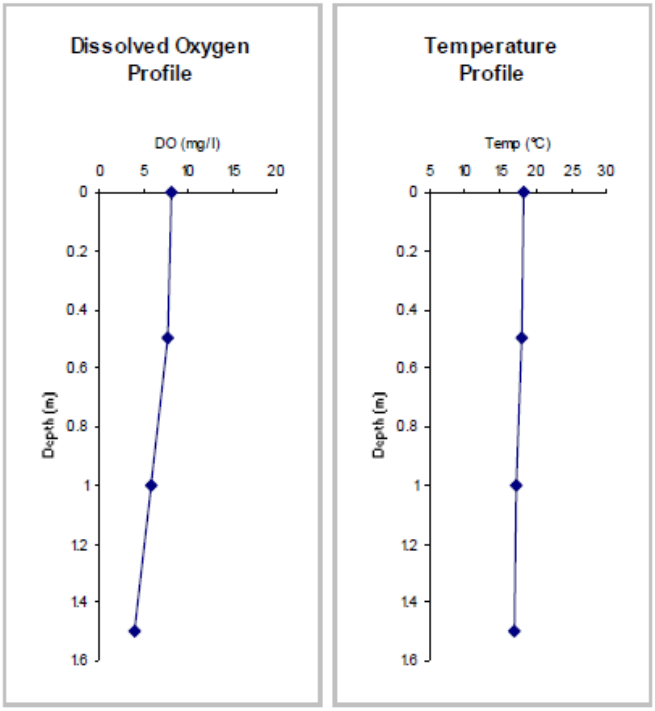
	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1989
TP	46.2	166.0	121.0	59.8	**98.3**	45.0
SRP	7.0	51.3	55.3	38.7	**38.1**	4.0
TN	0.78	1.09	1.79	1.00	**1.17**	0.79
TON	<0.005	<0.005	0.199	0.095	**<0.076**	0.10
Nitrite	<0.001	0.001	0.010	0.007	**<0.005**	-
Chl *a*	10.34	0.44	6.16	3.03	**4.99**	12.1
DOC	8.29	13.80	13.90	9.60	**11.40**	-
pH	8.00	7.26	7.44	7.48	**7.47**	7.78
Alk	244	211	181	156	**198**	231
Cond	479	404	416	373	**418**	456
Ca^{2+}	93.1	75.6	75.1	63.1	**76.7**	71.6
Mg^{2+}	5.94	5.04	4.97	4.08	**5.01**	6.8
Na^{+}	13.40	12.20	12.80	17.20	**13.90**	12.5
K^{+}	1.43	0.46	4.07	2.27	**2.06**	0.45
Cl^{-}	21.0	19.0	23.2	33.2	**24.1**	21.2
$SO4^{2-}$	<10	5.16	26.30	9.24	**<12.68**	8.9

Figure 46 Dissolved oxygen and temperature profile for Ballaghmore Lough (04/07/2014)

Dissolved Oxygen Profile

GPS Location	H2160043798
Maximum Depth (m)	2.1 m
Secchi Depth (cm)	140 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.13	18.2
0.5	7.69	17.9
1	5.91	17.2
1.5	3.95	16.9



Hydrology

Ballaghmore Lough receives an inflow of water via a small stream on the southwest shore, while the outflow is located to the southeast. This latter stream hydrologically connects Ballaghmore Lough to Rossole Lough, which soon feeds into the reaches of Upper Lough Erne. The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty with marginal substrates comprising of root bed mass. Ballaghmore Lough is situated on limestone bedrock, overlain by superficial till deposits.

Sediment load

There is slight grazing pressure but the disturbance appeared to be relatively low and no evidence of increased sediment loads was noted from the catchment.

Indicators of local distinctiveness

Charophytes, a characteristic species of this lake type, were not observed in the current survey.

Summary

As a result of having no characteristic species and poor water quality Ballaghmore Lough is classified as being in **unfavourable condition** for a hard oligo-mesotrophic lough. In addition to the current survey findings, there is also evidence that the site has deteriorated since last surveyed in 1989, with the probable loss of not only *Chara globularis,* but also *Potamogeton praelongus*. *Elodea canadensis* occurs as a persistent component of the aquatic flora at the site.

Although the submerged and floating-leaved aquatic flora was limited, a rich and diverse community of emergent and marginal species was recorded. The water

chemistry was typical of the lake type, with base-rich water and high alkalinity, but total phosphorus was above the level set out in the CSM guidelines and above the TP concentration recorded in 1989. The site was however dominated by macrophytes throughout the open water and Chl *a* concentrations were generally low and the water clear. The lough lies within an area of mainly improved pasture and while there was no direct evidence of nutrient inputs, it is likely that the site received diffuse nutrient pollution from the catchment.

Lough Ballaghmore is very shallow, and exhibits many characteristics of the “natural eutrophic lake” type. Palaeoecological evidence would be beneficial in determining to what extent the site once precipitated carbonates and to set site specific targets for aquatic macrophyte community composition.

Table 209 Ballaghmore Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Ballaghmore Lough NI Lake 735	**Unfavourable**	No charophytes present. Limited submerged and floating aquatic flora. High TP concentrations.	Rich and diverse emergent wetland vegetation. Possible enrichment from adjacent agricultural fields – further investigation required.

Species list

Table 210 List of all plant species recorded at Ballaghmore Lough

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	O
Alnus glutinosa	F
Angelica sylvestris	R
Caltha palustris	R
Carex disticha	O
Carex elata	R
Carex nigra	F
Carex paniculata	R
Carex rostrata	O
Cicuta virosa	F
Epilobium hirsutum	O
Epilobium palustre	R
Equisetum fluviatile	F
Filipendula ulmaria	R
Galium palustre	O
Hydrocotyle vulgaris	R
Iris pseudacorus	O
Juncus acutiflorus	R
Lysimachia vulgaris	O
Lythrum salicaria	R
Mentha aquatica	O
Mentha sp.	R
Menyanthes trifoliata	F
Myosotis scorpioides	R
Phalaris arundinacea	O
Phragmites australis	F
Potentilla palustris	R
Ranunculus lingua	R
Salix sp.	F
Schoenoplectus lacustris	F
Senecio aquaticus	R
Solanum dulcamara	O
Sparganium emersum	F
Sparganium erectum	R
Typha latifolia	R
Valeriana officinalis	R
Veronica beccabunga	R
Veronica scutellata	R
Submerged & floating species	**% Frequency (n = 76)**
Elodea canadensis	28
Lemna minor	+
Lemna trisulca	90
Nuphar lutea	65
Potamogeton natans	12
Ranunculus aquatilis agg.	1
Ranunculus circinatus	1

Survey data

Site Condition Assessment: Ballaghmore Lough (04/07/2014)

Lake Details		**Survey Details**		
Lake Name	Ballaghmore Lough	Survey Date	04/07/2014	
SSSI Name		Surveyors	SG, EA, BG	
SAC Name		Shore Surveys	2	out of
Grid Ref	H216438	Wader Surveys	2	2
WBID / NI No.	50349 / 735	Boat Surveys	2	sections

Site Notes:
Amazing wetland! Open water - 2m max depth. Dominated by N lutea and L. tri. Few other species inc. P nat and Ran circ.

Survey Notes:

Section Summaries

Section 1	Maximum depth of colonisation (cm)	200
	Compass bearing of boat transect (°)	130 °
	Lateral distance from waters edge to 75cm depth (m)	2 m
	Notes:	
Section 2	Maximum depth of colonisation (cm)	220
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	2 m
	Notes:	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H2168543842	H2168443739	H2168743785	H2161743798
Section 2	H2158143744	H2152443818	H2155043780	H2160343798

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	2576	2577	2585
Section 2	2586	2587	2588

3.41. Castlehume Lough (HA VSh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	01 August 2014
NI Lake Number:	745
WBID:	50017
County:	Fermanagh
Grid reference:	H195503
OS Grid reference (X,Y):	219539,350341
Shoreline development index:	1.274
Surface area (ha.):	56.2
Maximum recorded depth (m):	8.4

Table 211 Condition Assessment Summary Table for Castlehume Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species, should be present (excluding *C. vulgaris*)	✓	3 species: *Chara contraria, Chara globularis & Chara rudis.*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	27% of vegetated sample spots comply.
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 3.6% of sample sites. *Elodea nuttallii* present in 68.2% of sample sites. Zebra mussel extensive in some areas.

Attribute	Target	Status	Comment
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 3.6% of sample sites. *Elodea nuttallii* present in 68.2% of sample sites. Zebra mussel (*Dreissena polymorpha*) extensive in some areas.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Filamentous algae present and extensive in some areas but very few 3's recorded.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X?**	Reed fringed site with *S. lacustris* & *P. australis* dominating. Beyond the reed fringe a *N. lutea zone* up to depths of 4.7m with occasional *N. alba*. *Chara rudis* abundant at 1.8-2.4m depth. Submerged form only of *S. sagittifolia* abundant at 2.6-3.9m depth. *P. lucens* up to 3.5m and *P. friesii* up to 4.2m depth. *E. nuttallii* common at all depths up to 4.8m and *L. trisulca* common in shallower water smothering other macrophytes also present at deeper water (up to 4.5m) growing on the lake bed.
	Maximum depth distribution should be maintained	✓**?**	Z_{max} = 8.4 m, Z_{s} = 4.68 m, Z_{v} = 4.8 m
	At least the present structure should be maintained	✓	*Chara rudis* and *Chara globularis* recorded in 1988 survey (NILS). Similar plant community present.
Water quality	Stable nutrient levels: TP target / limit = 15 μgl^{-1}	**X**	TP = 26.1 μgl^{-1} (18 – 43 μgl^{-1}) & TN = 0.69 mgl^{-1} (April '14 – Feb '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.13 (range = 8.0 – 8.3)
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	**X**	Waters were well oxygenated to 6.0 m (> 7 mgl^{-1}). DO <5 mgl^{-1} below the thermocline.
	No excessive growth of cyanobacteria or green algae	✓	No blooms noted
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained. In places, especially near golf course heavily managed/ macrophyte cutting.
	Natural and characteristic substrate maintained	✓	No evidence of change.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓?	Catchment land cover is mainly rough pasture, golf course and woodland. High sediment load near the inflow but natural throughout the rest of the lough
Indicators of local distinctiveness	Distinctive elements maintained	?	Charophytes present but in low abundance.
	Minimal negative impacts	✓?	Moderate pressure from the golf course and holiday dwellings at the lough erne resort.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 56.2 ha, with no loss of extent of open water.

Macrophyte community composition

Castlehume has a good diversity of macrophyte taxa with this survey recording 26 species of submerged and floating leaved taxa. Three species of charophyte were recorded in the recent survey of Castlehume Lough; *Chara contraria, Chara globularis &* the nationally threatened *Chara rudis. Chara rudis* was the most abundant of the 3 *Chara* species growing in a distinct zone at ~2m depth. 5 *Potamogeton spp*. were recorded including *P. lucens* and *P. friesii. Elodea nuttallii* was recorded at a high frequency where it has probably arrived from neighbouring Lough Erne. Other notable species recorded in the 2014 survey include; *Myriophyllum verticillatum*, *Butomus umbellatus* and *Stratiodes aloides*. *S. aloides* is recorded from Castlehume Lough for the first time. Forbes (2000) states that Lough Yoan is the most northerly location in the Lough Erne catchment for this species but the record in this report supersedes this as Castlehume Lough is ~6km north of Lough Yoan. This could represent recent spread of *S. aloides* as it was not recorded in the 1988 NILS survey at this site.

The NI lake survey (NILS) recorded a very similar set of species at Castlehume Lough as the current survey. Notable differences were the presence of *Potamogeton perfoliatus* and *Littorella uniflora* in 1988 but absent in the current survey. *E. nuttallii, Potamogeton natans, Potamogeton berchtoldii, Myriophyllum spicatum,* and *Oenanthe aquatica* were all recorded in the current survey but not in the NILS survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were almost identical to those calculated form the NILS 1988 data, suggesting that the sites macrophyte composition is stable (Table 212).

Negative indicator species

Elodea nuttallii was found at 68.2% frequency in the current survey, found at all vegetated depths. It is a recent addition to the flora of Castlehume Lough and has spread to many other satellite loughs in the Erne catchment. Where it occurs *E. nuttallii* is known to displace *E. canadensis* (Simpson 1990), which appears to be the case here.

Zebra mussel (*Dreissena polymorpha*) was also recorded in the current survey. Zebra mussels are abundant in Lough Erne and its satellite loughs. The macrophyte

composition hasn't changed significantly since the NILS survey, which was performed before Zebra Mussels arrived in the area so an assumption can be made that the Zebra Mussels have had little effect of the macrophyte community as yet.

Table 212 Aquatic macrophyte community composition for Castlehume Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=110)***
Charophytes	**8.5**	**7.69**	**5**	**-**	**-**	**-**
Chara contraria	**-**	**-**	**-**	**8.5**	**7.69**	**8.2**
Chara globularis	**-**	**-**	**-**	**8.5**	**7.69**	**0.9**
Chara rudis	**8.5**	**7.69**	**+**	**8.5**	**7.69**	**21.8**
Elodea canadensis	8.5	7.95	3	8.5	7.95	37.4
Elodea nuttallii	-	-	-	10.0	7.95	68.2
Fontinalis antipyretica	6.3	5.38	3	6.3	5.38	9.1
Littorella uniflora	6.5	4.23	2	-	-	-
Lemna minor	9.0	8.85	2	-	-	-
Lemna trisulca	10.0	8.85	2	10.0	8.85	74.5
Myriophyllum spicatum	-	-	-	10.0	8.85	2.7
Myriophyllum verticillatum	-	-	3	-	-	0.9
Nuphar lutea	8.5	6.92	4	8.5	6.92	57.3
Nymphaea alba	6.7	3.08	2	6.7	3.08	1.8
Oenanthe aquatica	-	-	-	-	-	16.4
Persicaria amphibia	9.0	7.65	+	-	-	-
Potamogeton berchtoldii	-	-	-	7.3	7.69	0.9
Potamogeton friesii	10.0	9.26	2	10.0	9.26	3.6
Potamogeton lucens	10.0	7.88	4	10.0	7.88	11.8
Potamogeton natans	-	-	-	6.7	4.23	+
Potamogeton pectinatus	10.0	8.85	2	10.0	8.85	3.6
Potamogeton perfoliatus	7.3	7.69	2	-	-	-
Ranunculus circinatus	10.0	8.85	3	10.0	8.85	6.4
Sagittaria sagittifolia	-	-	5	-	-	32.7
Sparganium emersum	10.0	7.5	3	10.0	7.5	0.9
Stratiodes aloides	-	-	-	-	-	+
Utricularia vulgaris agg.	5.5	4.23	3	5.5	4.23	22.7
Average score	**8.5**	**7.2**		**8.6**	**7.4**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Macrophyte community structure

Castlehume Lough is bordered by reed beds that are dominated by *S. lacustris* and *P. australis*, with rough pasture, woodland, golf course and dwellings beyond. *N. lutea (*and occasionally *N. alba)* fringed the lough, growing to depths of up to 4.7m. A clear zone of *Chara rudis* was present at ~2m depth. *P. lucens* grew up to 3.4m and *P. friesii* up to 4.2m. The submerged form of *S. sagittifolia* was abundant at 2.6-3.9m depth, very few emergent 'arrowhead' leaves were observed in this survey. *E. nuttallii* was common at all depths up to 4.8m and *L. trisulca* was common in shallower water smothering other macrophytes but was also present at deeper water (up to 4.5m) growing on the lake bed. *S. aloides* was not observed in the survey sections but was discovered growing by the footbridge near the Lough Erne resort hotel which is near the inflow.

Water quality

Table 213 Water chemistry data for Castelhume Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	20.9	18.4	43.4	21.5	26.1	19
SRP	4.3	5.1	13.8	12.1	8.8	3
TN	0.47	0.47	0.81	1.01	0.69	0.33
TON	0.068	<0.005	0.212	0.666	<0.24	-
Nitrite	0.002	<0.001	0.016	0.006	<0.006	-
Chl *a*	4.90	6.20	1.65	0.70	3.36	7.35
DOC	3.91	4.45	5.12	4.23	4.43	-
pH	8.32	8.11	7.96	8.22	8.13	8.16
Alk	187	123	173	189	168	79
Cond	390	316	369	405	370	350
Ca^{2+}	71	52.7	63.2	73.6	65.1	52
Mg^{2+}	5.11	5.3	5.59	4.99	5.25	4.8
Na^{+}	10.2	10.5	10.4	11.9	10.75	10.8
K^{+}	2.03	1.94	2.74	2.28	2.25	1.5
Cl^{-}	20	18.8	19.3	22.5	20.2	25.1
SO_4^{2-}	<10	7.79	14.1	12.1	<11.0	12.4

The water chemistry of Castlehume Lough is typical of hard oligo-mesotrophic lakes and ponds, having base-rich water. Total phosphorus is above the limit set out in the CSM guidelines for this lake type (15 $\mu g l^{-1}$ JNCC 2015) and TN is at an acceptable level for this type of lake. Filamentous algae is present but below levels deemed unfavourable (<10%), although it was observed to be extensive near the inflow. Chlorophyll a levels are low. The upper 6.0 m of the water column was well oxygenated (> 7.0 $mg l^{-1}$), rapidly declining to 0.52 $mg l^{-1}$ at 8m depth (Figure 47).

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty

Sediment load

The dominant land cover in the catchment is rough pasture, although close to the lough there is a golf course and mixed woodlands, the disturbance appears to be relatively low around most of the lough although the shores near the golf course are managed with some evidence of macrophyte cutting and bank modification. Throughout most of the lough the sediment load appears natural, with some heavy silt build up near the inflow.

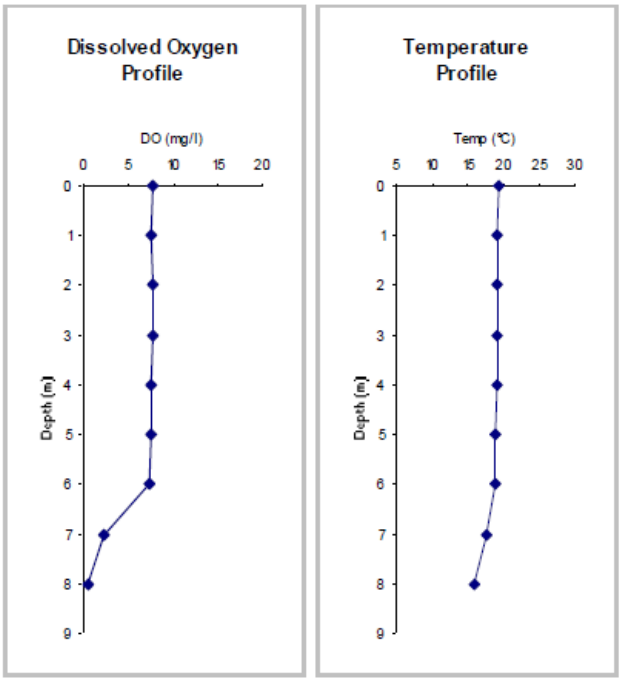
Figure 47 Dissolved oxygen and temperature profile for Castlehume Lough (01/08/2014)

Dissolved Oxygen Profile

GPS Location	H1955450280
Maximum Depth (m)	8.4 m
Secchi Depth (cm)	468 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	7.7	19.2
1	7.5	19.1
2	7.69	19
3	7.69	19
4	7.62	19
5	7.56	18.9
6	7.45	18.9
7	2.26	17.5
8	0.52	15.9



Indicators of local distinctiveness

Three species of charophyte were recorded; *Chara contraria, Chara globularis* and the nationally threatened *Chara rudis. Chara rudis* was present at a reasonably high frequency and occupied a clear zone at around 2m depth.

Summary

Castlehume Lough has a diverse macrophyte assemblage with 26 submerged and floating leave taxa recorded on the most recent survey. Despite this, Castlehume Lough is classed as being in **Unfavourable condition.** The characteristic charophyte flora, although present, is not extensive enough and does not occupy >50% of the photic zone. Three *Chara* species were present including the nationally threatened *Chara rudis* which was present throughout the lough. The water chemistry was typical of the lake type with clear waters (Z_S = 4.68 m), although total phosphorus was just above the limit set out in the CSM guidelines. Throughout most of the lough filamentous algal growth was limited and chlorophyll a concentrations were low. The presence of *S. aloides* is notable being the most northerly record in the Erne catchment. *E. nuttallii* has spread throughout the lough since the NILS

survey when only *E. canadensis* was present. Zebra mussels were also probably absent from the lough at the time of the NILS survey, now they are common throughout the lough and elsewhere in the Erne catchment. Despite these changes the macrophyte community is little changed since the NILS survey. The impact of the golf course and the holiday dwellings on the lake shore is unknown, but filamentous algal growth is most dominant around these areas.

Table 214 Castlehume Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Castlehume Lough NI Lake 745	**Unfavourable**	*Chara* present at low frequency (<50% of photic zone). High TP. *E. nuttallii* and zebra mussel present.	*Chara rudis* present in clear zone. Good diversity of aquatic macrophytes. *S. aloides*, *P. lucens* and *P. friesii* present.

Species list

Table 215 List of all plant species recorded at Castlehume Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Alisma plantago-aquatica	R
Alnus glutinosa	R
Apium nodiflorum	R
Butomus umbellatus	R
Carex paniculata	R
Carex rostrata	R
Elodea canadensis	R
Epilobium hirsutum	R
Equisetum fluviatile	R
Filipendula ulmaria	R
Fraxinus excelsior	R
Iris pseudacorus	R
Lycopus europaeus	R
Lysimachia vulgaris	R
Lythrum salicaria	R
Menyanthes trifoliata	R
Phalaris arundinacea	R
Phragmites australis	F
Rumex hydrolapathum	R
Salix sp.	R
Schoenoplectus lacustris	O
Sparganium erectum	R
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 110)**
Chara contraria	8.2
Chara globularis	0.9
Chara rudis	21.8
Elodea canadensis	37.4
Elodea nuttallii	68.2
Fontinalis antipyretica	9.1
Lemna trisulca	74.5
Myriophyllum spicatum	2.7
Myriophyllum verticillatum	0.9
Nuphar lutea	57.3
Nymphaea alba	1.8
Oenanthe aquatic	16.4
Potamogeton berchtoldii	0.9
Potamogeton friesii	3.6
Potamogeton lucens	11.8
Potamogeton natans	+
Potamogeton pectinatus	3.6
Ranunculus circinatus	6.4
Sagittaria sagittifolia	32.7
Sparganium emersum	0.9
Stratiodes aloides	+
Utricularia vulgaris agg.	22.7

Survey data

Site Condition Assessment: Castlehume Lough (01/08/2014)

Lake Details		Survey Details		
Lake Name	Castlehume Lough	Survey Date	01/08/2014	
SSSI Name		Surveyors	SD & EW	
SAC Name		Shore Surveys	3	out of
Grid Ref	H195503	Wader Surveys	3	3
WBID / NI No.	50017 / 745	Boat Surveys	3	sections

Site Notes:

Survey Notes:
Zebra Mussels present. Water Soldier, P.natans and Butomus umbellatus present but not recorded in survey. Very eutrophic at hotel and bridge and pond area, lots of fil alg R.circinatus and L.trisulca. Chara rudis present

Section Summaries

Section 1	Maximum depth of colonisation (cm)	450 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	5 m
	Notes:	
Section 2	Maximum depth of colonisation (cm)	480 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	4 m
	Notes:	
Section 3	Maximum depth of colonisation (cm)	430 cm
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	8 m
	Notes: zebra mussel	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H1925750500	H1924450597	H1925550548	H1934250550
Section 2	H1943150877	H1952950872	H1947950876	H1947850599
Section 3	H1934149983	H1926550045	H1929249993	H1938950090

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0113	0114	0115
Section 2	0131	0132	-
Section 3	0135	0136	0137

3.42. Aleen Lough (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

Survey Date	04 August 2014
NI Lake Number:	751
WBID:	50198
County:	Fermanagh
Grid reference:	H139544
OS Grid reference (X,Y):	213864,354401
Shoreline development index:	1.539
Surface area (ha.):	6.7
Maximum recorded depth (m):	8.2

Table 216 Condition Assessment Summary Table for Aleen Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	2 species: *Chara aculeolata* & *Chara contraria*
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	12% of vegetated sample spots comply.
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 12% of sample plots, an acceptable frequency for an established invasive species.

Attribute	Target	Status	Comment
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 12% of sample plots.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Filamentous algae present, but did not exceed 10%, mostly 1's.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Reed fringed site dominated by *S. lacustris* and *P. australis* but also including; *C. mariscus, C. rostrata and E. fluviatile. N. lutea* grows up to depths of 3.9 m. A dense zone of *P. lucens* in section 3 at 1.9 – 2.9 m depth. Charophytes only present in the shallows (< 75cm) and mainly in section 2. *E. canadensis* present at low frequency throughout. Marginal species included; *A. plantago-aquatica*, *Apium nodiflorum* and *Veronica beccabunga*.
	Maximum depth distribution should be maintained	✓	Z_{max} = 8.2 m, Z_{s} = 2.45 m, Z_{v} = 3.9 m
	At least the present structure should be maintained	✓**?**	Charophytes recorded in 1988. In recent survey at only 12% occurrence.
Water quality	Stable nutrient levels: TP target / limit = 10 μgl^{-1}	**X**	TP = 31 μgl^{-1} (21 – 45 μgl^{-1}) & TN = 0.86 mgl^{-1} (April '14 – Feb '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.06 (range = 7.9 – 8.2)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	**X**	Waters were well oxygenated to 3.0 m (> 6 mgl^{-1}), below which levels rapidly dropped off to ≤ 1 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓**?**	No cyanobacteria blooms noted
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓**?**	Catchment land cover is mainly rough pasture. Poaching in places. High sediment load in section 3
Indicators of local distinctiveness	Distinctive elements maintained	✓**?**	Charophytes present but in low abundance.
	Minimal negative impacts	✓**?**	Moderate grazing pressure from cattle and slight poaching.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 6.7 ha, with no loss of extent of open water.

Macrophyte community composition

Two species of Charophyte were recorded in the recent survey of Aleen Lough; *Chara contraria* and *Chara aculeolata*. These two species were recorded at a low frequency (12%) and were only present in the shallows <75cm depth. Other taxa included; *Potamogeton lucens, Fontinalis antipyretica, Lemna trisulca* and *Elodea canadensis. Elodea canadensis* was present at a low frequency and nowhere did it dominate. Marginal and emergent species included*; Carex rostrata, Cladium mariscus, Iris pseudacorus, Phragmites australis, Schoenoplectus lacustris* and *Typha latifolia*. A total of 39 macrophyte taxa were recorded.

Table 217 Aquatic macrophyte community composition for Aleen Lough,

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=74)***
Callitriche sp.	-	-	1	-	-	-
Chara aculeolata	-	-	-	**8.5**	**7.69**	**7.3**
Chara contraria	-	-	-	**8.5**	**7.69**	**4.9**
Chara hispida major	**8.5**	7.69	2	-	-	-
Elodea canadensis	8.5	7.95	3	8.5	7.95	12.2
Fontinalis antipyretica	6.3	5.38	2	6.3	5.38	30.5
Lemna trisulca	-	-	-	10.0	8.85	22
Nuphar lutea	8.5	6.92	5	8.5	6.92	69.5
Potamogeton alpinus	5.5	5.38	1	-	-	-
Potamogeton coloratus	-	-	2	-	-	-
Potamogeton lucens	10.0	7.88	4	10.0	7.88	22
Average score	**7.7**	**6.88**		**7.9**	**6.88**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

There are some notable differences between the macrophyte taxa recorded in the current survey compared to the 1988 NI lake survey (NILS) of Aleen Lough. Species present in the NILS survey but not in the current survey were; *Potamogeton alpinus, Potamogeton coloratus, Chara hispida major* and *Callitriche sp*. Species present in the current survey but not recorded in the NILS survey are *C. contraria, C. aculeolata* and *L. trisulca*. The Charophytes recorded in the NILS survey of Aleen Lough are not given an abundance score so no comparison of abundance can be made. The absence of *P. coloratus* and *P. alpinus* suggests that the site may have deteriorated perhaps due to increasing eutrophication. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were similar to those calculated from the NILS 1988 data.

Negative indicator species

Elodea canadensis was found at 12.2% frequency in the current survey. It was present in the NILS survey and its current abundance is low, but nonetheless its presence is unfavourable.

Macrophyte community structure

Aleen lough is a reed fringed site dominated by *S. lacustris* and *P. australis* but also including; *C. mariscus, C. rostrata and E. fluviatile. Nuphar lutea* grows up to depths of 3.9 m. A dense zone of *P. lucens* in section 3 at 1.9 – 2.9 m depth. Charophytes only present in the shallows (< 75cm) and mainly in section 2. *Elodea canadensis* present at low frequency throughout. No species grew beyond the Lilly fringe. Marginal species included; *Alisma plantago-aquatica*, *Apium nodiflorum* and *Veronica beccabunga*.

Water quality

The water chemistry of Aleen Lough is typical of hard oligo-mesotrophic lakes and ponds, having base-rich water. Total phosphorus is above the limit set out in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015) and TN is high for this type of lake. Filamentous algae is present but below levels deemed unfavourable (<10%) and Chlorophyll a levels are low. The upper 3.0 m of the water column was well oxygenated (> 6 mgl^{-1}), rapidly declining to ~1 mgl^{-1} at depths greater than 4 m. (Figure 48).

Table 218 Water chemistry data for Aleen Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1988
TP	31.8	21.4	45.2	24	**31**	32
SRP	3.5	4.6	17.4	12	**9.38**	13
TN	0.65	0.49	1.14	1.14	**0.65**	-
TON	<0.005	<0.005	0.494	0.845	**<0.005**	-
Nitrite	0.002	<0.001	0.009	0.004	**<0.004**	-
Chl a	25.50	1.10	4.18	2.35	**8.28**	14.0
DOC	4.58	5.48	5.84	3.75	**4.91**	-
pH	8.21	8.02	7.9	8.16	**8.06**	7.99
Alk	217	222	253	213	**226**	127
Cond	436	445	495	461	**459**	494
Ca2+	86.7	85.9	95.4	80.6	**87.2**	88.6
Mg2+	4.13	4.66	5	3.97	**4.44**	4.2
Na+	10.7	10.9	11.1	14.5	**11.8**	12.8
K+	2.16	2.46	2.83	2.3	**2.44**	1.7
Cl-	19.6	17.2	18.7	30.4	**21.5**	28.92
SO42-	<10	9.08	12	9.14	**<10.06**	11.25

Hydrology

The hydrological regime at the site appears natural.

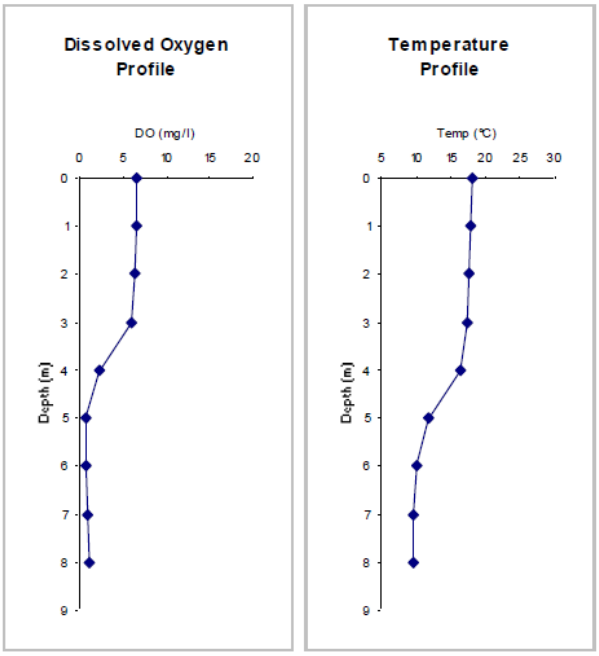
Lake substrate
The lake basin is predominantly silty.

Figure 48 Dissolved oxygen and temperature profile for Aleen Lough (04/08/2014)

Dissolved Oxygen Profile

GPS Location	H1393854380
Maximum Depth (m)	8.2 m
Secchi Depth (cm)	245 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	6.67	18
1	6.64	17.9
2	6.5	17.7
3	6.09	17.3
4	2.4	16.4
5	0.77	11.8
6	0.87	10.1
7	0.98	9.6
8	1.25	9.7



Sediment load
The dominant land cover in the catchment is rough pasture and though there is moderate grazing pressure and slight poaching from cattle. The sediment load in section 3 was higher than would be expected with deep silt in the margins which made surveying difficult.

Indicators of local distinctiveness
Two species of charophyte were recorded; *Chara contraria and Chara aculeolata.* However these species were not recorded in abundance and only in the margins at depths less than 0.75 m.

Summary
Aleen Lough is classed as being in **Unfavourable condition.** The characteristic Charophyte flora appears to be very limited and no individuals were found growing at depth, a mandatory condition for a marl lake to meet favourable condition. The water chemistry was typical of the lake type, though total phosphorus was above the limit set out in the CSM guidelines and TN was also high. The water clarity was moderate with low levels of filamentous algal growth and low Chlorophyll a concentrations. The absence of *P. coloratus* and *P. alpinus* suggest at a trophic shift since the NILS survey, although this could be due to methodological differences. Good frequency of *P. lucens* was noted particularly in section 3. There is moderate grazing pressure and slight cattle poaching with an increased sediment load in places. Less intensive agriculture around the shore and within the catchment would be beneficial. Angling

occurs at the site and therefore the risk of zebra mussel introduction is high given its proximity to Lough Erne.

Table 219 Aleen Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Aleen Lough NI Lake 751	**Unfavourable**	2 *Chara* spp. present at low frequency. High TP.	Lack of diversity and abundance of *Chara* species. Abundance of *P. lucens* is encouraging. *C. mariscus* in the margins

Species list

Table 220 List of all plant species recorded at Aleen Lough

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	F
Schoenoplectus lacustris	F
Alnus glutinosa	O
Fontinalis antipyretica	O
Juncus acutiflorus	R
Carex paniculata	R
Iris pseudacorus	R
Filipendula ulmaria	R
Caltha palustris	R
Angelica sylvestris	R
Mentha aquatica	R
Salix sp.	R
Juncus effusus	R
Senecio aquaticus	R
Myosotis scorpioides	R
Potentilla palustris	R
Lysimachia nummularia	R
Lysimachia vulgaris	R
Ranunculus flammula	R
Veronica beccabunga	R
Galium palustre	R
Epilobium hirsutum	R
Cladium mariscus	R
Apium nodiflorum	R
Rorippa nasturtium-aquaticum agg.	R
Juncus inflexus	R
Alisma plantago-aquatica	R
Stachys palustris	R
Equisetum fluviatile	R
Carex rostrata	R
Sparganium erectum	R
Typha latifolia	R
Menyanthes trifoliata	R
Submerged & floating species	**% Frequency (n = 40)**
Chara aculeolata	7
Chara contraria	5
Elodea canadensis	12
Fontinalis antipyretica	31
Lemna trisulca	22
Nuphar lutea	70
Potamogeton lucens	22

Survey data

Site Condition Assessment: Aleen Lough (04/08/2014)

Lake Details		**Survey Details**		
Lake Name	Aleen Lough	Survey Date	04/08/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H139544	Wader Surveys	3	3
WBID / NI No.	50198 / 751	Boat Surveys	3	sections

Site Notes:

2 the

1&2.

Survey Notes:
Lough deepest on the southern shore. Transects 1 &

shore drops off very quickly. Marl on P.lucens @

Transect 3 very silty and more eutrophic.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	390 cm
	Compass bearing of boat transect (°)	104 °
	Lateral distance from waters edge to 75cm depth (m)	3 m
	Notes:	
Section 2	Maximum depth of colonisation (cm)	380 cm
	Compass bearing of boat transect (°)	17 °
	Lateral distance from waters edge to 75cm depth (m)	3 m
	Notes:	
Section 3	Maximum depth of colonisation (cm)	350 cm
	Compass bearing of boat transect (°)	260 °
	Lateral distance from waters edge to 75cm depth (m)	-
	Notes:	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H1395954294	H1397054396	H1399154341	H1397954345
Section 2	H1389354474	H1379354474	H1383854473	H1384354465
Section 3	H1363254468	H1367554373	H1362554411	H1364654418

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0144	0145	0146
Section 2	0147	0149	0148
Section 3	0150	0153	0151

3.43. Carran Lough (HA VSh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	06 July 2014
NI Lake Number:	753
WBID:	50047
County:	Fermanagh
Grid reference:	H139478
OS Grid reference (X,Y):	213921,347805
Shoreline development index:	1.389
Surface area (ha.):	26.1
Maximum recorded depth (m):	10.1

Table 221 Condition Assessment Summary Table for Carran Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	1 species: *Chara contraria*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	3% of vegetated sample spots comply.
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 37% of sample sites. Zebra mussel extensive in some areas

Attribute	Target	Status	Comment
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 37% of sample sites. Zebra mussel extensive in some areas
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Filamentous algae present, but did not exceed 10%. Few 3's
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Reed fringed site with *S. lacustris* dominating with occasional *P. australis. N. lutea* grows up to depths of 2.7m. *P. lucens* and *P. perfoliatus* present in the shallows (<75cm) and up to 2m. *P. pectinatus* present at depths <75cm. *Chara contraria* present at 25cm. *E. canadensis* present up to 1.5m. .
	Maximum depth distribution should be maintained	**-**	Z_{max} = 10.1 m, Z_{s} = 1.93 m, Z_{v} = 2.7 m
	At least the present structure should be maintained	✓	Charophytes recorded in 1989. In recent survey at only 3% occurrence.
Water quality	Stable nutrient levels: TP target / limit = 15 μgl^{-1}	**X**	TP = 44 μgl^{-1} (40 – 53 μgl^{-1}) & TN = 1.01 mgl^{-1} (April '14 – Feb '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 7.84 (range = 7.5 – 8.2)
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	**X**	Waters were well oxygenated to 4.0 m (> 7.8 mgl^{-1}), below which levels rapidly dropped off to ≤ 0.5 mgl^{-1}. DO below the thermocline <5 mgl^{-1})
	No excessive growth of cyanobacteria or green algae	**✓?**	Blue green algae visible in the water column in section 3 but not forming a bloom.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	Catchment land cover is mainly rough pasture, Some evidence of poaching and erosion at the margins.
	Distinctive elements maintained	**✓?**	Charophytes present but in low abundance.

Attribute	Target	Status	Comment
Indicators of local distinctiveness	Minimal negative impacts	✓?	Moderate grazing pressure from cattle and slight poaching.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 26.1 ha, with no loss of extent of open water.

Macrophyte community composition

One species of charophyte was recorded in the recent survey of Carran Lough; *Chara contraria*. This single species was recorded at a low frequency (3%) and was only present at <25cm depth. *Potamogeton lucens* and *Potamogeton pectinatus* were present at high frequency throughout the lough (46% and 32% respectively). *Potamogeton perfoliatus* was less frequent but was present in all survey sections.

Table 222 Aquatic macrophyte community composition for Carran Lough, including trophic scores

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=123)***
Charophytes	**8.5**	**7.69**	**3**	**-**	**-**	**-**
Chara contraria	**-**	**-**	**-**	**8.5**	**7.69**	**3.3**
Chara globularis	**8.5**	**7.69**	**+**	**-**	**-**	**-**
Elodea canadensis	8.5	7.95	5	8.5	7.95	37.4
Lemna minor	9	8.85	1	-	-	-
Nuphar lutea	8.5	6.92	3	8.5	6.92	67.5
Potamogeton alpinus	-	-	-	5.5	5.38	+
Potamogeton berchtoldii	-	-	-	7.3	7.69	2.4
Potamogeton obtusifolius	7.3	6.54	1	-	-	-
Potamogeton pectinatus	10.0	8.85	3	10.0	8.85	31.7
Potamogeton perfoliatus	7.3	7.69	3	7.3	7.69	8.1
Potamogeton lucens	10.0	7.88	4	10.0	7.88	46.3
Sparganium emersum	-	-	-	10.0	7.5	4.1
Zannichellia palustris	-	-	-	10.0	8.85	0.8
Average score	**8.6**	**7.8**		**8.6**	**7.6**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

The NI lake survey (NILS) recorded a similar set of species at Carran Lough as the current survey. Notable differences were the presence of *Potamogeton obtusifolius*

and *Lemna minor* in 1989 but absent in the current survey. *Zannichellia palustris, Potamogeton alpinus* and *Sparganium emersum* were all recorded in the current survey but not in the NILS survey. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were almost identical to those calculated from the NILS 1989 data.

Negative indicator species

Elodea canadensis was found at 37.4% frequency in the current survey. It was present in the NILS survey and its persistent presence is unfavourable.

Zebra mussels (*Dreissena polymorpha*) were also recorded in the current survey. Zebra mussels are abundant in Lough Erne and its satellite loughs. It is likely that they have reached Carran Lough through the activities of anglers as the lough is hydrologically isolated from Lough Erne.

Macrophyte community structure

Carran Lough is bordered by reed beds that are dominated by *S. lacustris* and to a lesser extent *P. australis*, with rough pasture beyond. *N. lutea* fringed the lough, growing up to depths of 2.7 m. *Potamogeton lucens* grew occasionally in shallow water <50cm but more abundantly in deeper water up to 2 m. *Potamogeton pectinatus* was recorded commonly in the shallows <75cm as was *Elodea canadensis*. The only *Chara* species, *Chara contraria,* was recorded in four plots all at 25cm depth.

Water quality

Table 223 Water chemistry data for Carran Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1989
TP	53.3	41.8	40.5	41.5	**44**	20
SRP	7.4	8.4	10.8	23.5	**12.5**	5
TN	1.06	0.67	1.2	1.09	**1.01**	0.6
TON	0.369	0.0239	0.261	0.534	**0.297**	-
Nitrite	0.007	0.004	0.003	0.005	**0.005**	-
Chl *a*	21.56	4.29	0.66	0.55	**6.77**	10.4
DOC	6.13	6.72	11.2	6.67	**7.68**	-
pH	8.03	8.18	7.48	8.04	**7.84**	8.23
Alk	125	80	145	117	**117**	75.5
Cond	282	285	314	282	**291**	330
Ca^{2+}	51.9	48.9	55.6	44.6	**50.3**	51.4
Mg^{2+}	3.09	3.51	3.48	3.1	**3.30**	4
Na^{+}	9.17	9.75	9.41	11.5	**9.96**	14
K^{+}	1.86	1.99	2.69	2.23	**2.19**	0.55
Cl^{-}	15.4	15	15.7	22.2	**17.1**	18.1
SO_4^{2-}	9.17	9.75	9.41	11.5	**9.96**	12.2

The water chemistry of Carran Lough is typical of hard oligo-mesotrophic lakes and ponds, having base-rich water. Total phosphorus is above the limit set out in the CSM guidelines for this lake type (15 μgl^{-1} JNCC 2015) and TN is high for this type of lake. Filamentous algae is present but below levels deemed unfavourable (<10%) and mean Chlorophyll a levels are low, despite a high spring value. The upper 4.0 m of the water column was well oxygenated (> 7.8 mgl^{-1}), rapidly declining to ~0.5 mgl^{-1} at depths greater than 6.0 m. (Figure 49). The mean DO below the thermocline was less than 5 mgl^{-1}, which does not meet guideline levels (JNCC 2015).

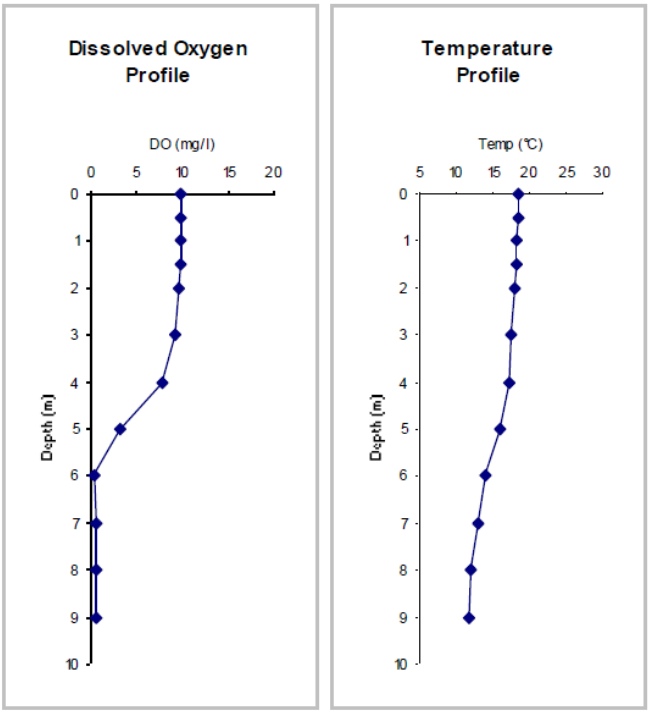
Figure 49 Dissolved oxygen and temperature profile for Carran Lough (06/07/2014)

Dissolved Oxygen Profile

GPS Location	H1394947689
Maximum Depth (m)	10.1 m
Secchi Depth (cm)	1.93 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	9.8	18.4
0.5	9.82	18.4
1	9.83	18.3
1.5	9.82	18.3
2	9.66	18
3	9.15	17.6
4	7.8	17.3
5	3.26	15.9
6	0.48	14.1
7	0.5	13
8	0.55	11.9
9	0.6	11.8



Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty

Sediment load

The dominant land cover in the catchment is rough pasture and though there is moderate grazing pressure and slight poaching from cattle, the disturbance appears to be relatively low. No evidence of increased sediment loads to the lough was noted from the catchment.

Indicators of local distinctiveness

Two species of charophyte was recorded; *Chara contraria.* However this species was not recorded in abundance and only at the margin within a depth less than 0.25 m.

Summary

Carran Lough is classed as being in **Unfavourable condition.** The characteristic charophyte flora appears to be very limited and no individuals were found growing at depth, a mandatory condition for a marl lake to meet favourable condition. The water chemistry was typical of the lake type, though total phosphorus was above the limit set out in the CSM guidelines and TN is also high. The water clarity was good with low levels of filamentous algal growth and chlorophyll a concentrations, although water clarity can be improved by zebra mussels which are present at the site. High frequency of *Potamogeton pectinatus* is atypical for a marl lake as it can be indicative of eutrophic conditions. There is moderate grazing pressure and slight cattle poaching, but no evidence of increased sediment loading to the lough was observed. Less intensive agriculture around the shore and within the catchment would be beneficial. Angling appears to be encouraged at the site and the presence of zebra mussel is perhaps associated with this activity.

Table 224 Carran Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Carran Lough NI Lake 753	**Unfavourable**	Only 1 *Chara* spp. present at low frequency. High TP *E. canadensis* and zebra mussel present.	Lack of diversity and abundance of *Chara* species. Abundance of *P. lucens* and *P. perfoliatus* is encouraging but presence of *P. pectinatus* is also an indication of eutrophication

Species list

Table 225 List of all plant species recorded at Carran Lough

Marginal & Emergent species	**Abundance (DAFOR)**
Schoenoplectus lacustris	F
Phragmites australis	R
Carex rostrata	R
Myosotis scorpioides	R
Equisetum fluviatile	R
Galium palustre	R
Hydrocotyle vulgaris	R
Caltha palustris	R
Salix sp.	R
Ranunculus flammula	R
Lythrum salicaria	R
Senecio aquaticus	R
Carex vesicaria	R
Juncus acutiflorus	R
Sparganium emersum	R
Juncus inflexus	R
Eleocharis palustris	R
Mentha sp.	R
Iris pseudacorus	R
Alisma plantago-aquatica	R
Carex sp.	R
Carex nigra	R
Lysimachia vulgaris	R
Phalaris arundinacea	R
Filipendula ulmaria	R
Alnus glutinosa	R
Sparganium erectum	R
Submerged & floating species	**% Frequency (n = 123)**
Chara contraria	3
Elodea canadensis	37
Nuphar lutea	68
Potamogeton alpinus	+
Potamogeton berchtoldii	2
Potamogeton pectinatus	32
Potamogeton perfoliatus	8
Potamogeton lucens	46
Sparganium emersum	4
Zannichellia palustris	1

Survey data

Site Condition Assessment: Carran Lough (06/07/2014)

Lake Details		Survey Details		
Lake Name	Carran Lough	Survey Date	06/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	4	out of
Grid Ref	H139478	Wader Surveys	4	4
WBID / NI No.	50047 / 753	Boat Surveys	4	sections

Site Notes:

Survey Notes:
Zebra Mussels present. Silty Clay substrate at either end of the lough.
Extensive P.lucens and P.perfoliatus. Enteromorpha algae present.

Section Summaries

Section 1

Maximum depth of colonisation (cm)	230 cm
Compass bearing of boat transect (°)	197 °
Lateral distance from waters edge to 75cm depth (m)	30 m

Notes: Section 1 Point 4 at the outflow. Enteromorpha

Section 2

Maximum depth of colonisation (cm)	200 cm
Compass bearing of boat transect (°)	80 °
Lateral distance from waters edge to 75cm depth (m)	3 m

Notes: Extensive zebra mussels

Section 3

Maximum depth of colonisation (cm)	230 cm
Compass bearing of boat transect (°)	297 °
Lateral distance from waters edge to 75cm depth (m)	2 m

Notes: Zebra Mussels present. Surface blue green algae

Section 4

Maximum depth of colonisation (cm)	270 cm
Compass bearing of boat transect (°)	35 °
Lateral distance from waters edge to 75cm depth (m)	10 m

Notes:

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H1384048282	H1393648289	H1388648299	H1388948247
Section 2	H1386048062	H1388947967	H1388348014	H1388848016
Section 3	H1407548020	H1407847916	H1406847970	H1405547980
Section 4	H1389447383	H1380647425	H1384847399	H1385647421

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0205	0206	0207
Section 2	0208	0209	0210
Section 3	0213	0214	0215
Section 4	0216	0217	0218

3.44. Lough Yoan (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

Survey Date	01/07/2014
NI Lake Number:	763
WBID:	50113
County:	Fermanagh
Grid reference:	H253423
OS Grid reference (X,Y):	225326,342251
Shoreline development index:	1.61
Surface area (ha.):	13.5
Maximum recorded depth (m):	3.3

Table 226 Condition Assessment Summary Table for Lough Yoan

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	None
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	1 present: *Chara globularis*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	7% of vegetated sample spots comply (4% wader, 11% boat)

Attribute	Target	Status	Comment
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 52% of sample sites.
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 52% of sample sites.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Minimal filamentous algae cover: 3.8% wader transects, 7.5% boat transects. 0% sampling points scored a '3'.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Good marginal zone consisting of wet woodland and a mix of understory species and low growing herbs. An emergent zone of *P. australis, S. lacustris, E. fluviatile, C. rostrata* and *T. latifolia* surrounds the lough. *N. lutea* frequent to 2.3 m, interspersed by *L. trisulca. P. praelongus* frequent up to 2.3 m and *P. crispus locally* frequent. *P. natans* on strandline of S3. *C. globularis* sparse growth between 0.75 – 1.95 m (S1-3). *M. verticillatum* abundant (0.5 – 2.6 m and at 3.3 m). *E. canadensis* frequent in S1-4 (0.25-1.4 m). One record of *S. aloides* in S1 at 0.5 m. Site lacks the extensive *Chara* beds.
	Maximum depth distribution should be maintained	✓	Z_{max} = 3.3 m, Z_{s} = 2.7 m, Z_{v} = 2.6 m
	At least the present structure should be maintained	**X?**	Similar to NILS 1988, but possible decline of *Chara* spp..
Water quality	Stable nutrients levels: TP target / limit = 10 μgl^{-1}	**X**	TP = 33.0 μgl^{-1} (range 18.5 – 42.6 μgl^{-1}) & TN = 0.71 mgl^{-1} (April '14 – Feb. '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.02 (range = 7.7 – 8.5)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	✓	No thermocline present. DO declined with depth, but mean DO was 8.5 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	No excessive algal growth reported.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓	Catchment land cover is mainly broadleaf woodland, with some improved grazing to the NE. There was no evidence increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	✓?	*Myriophyllum verticillatum* abundant.
	Minimal negative impacts	✓?	No apparent negative impacts.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 13.5 ha, with no loss of extent of open water.

Macrophyte community composition

Chara globularis was only observed sporadically in sections 1, 2 and 3, with mostly '1's indicating the abundance as 'rare'. The 1988 NILS survey records 'charophytes' as frequent ("3" on a 1-5 scale). No other characteristic species were recorded in 2014. Furthermore, only 7% of the vegetated sample plots had charophytes present and therefore Lough Yoan is 'unfavourable' with respect to the aquatic flora. The 1988 survey did not specify which charophyte species was present and no other characteristic species were listed. Apart from *Hippuris vulgaris, Myriophyllum spicatum* and *Fontinalis antipyretica*, all the species observed in 1988 were recorded in the 2014 survey, with no additional species to note.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.4 and 7.23 respectively (Table 227), which are similar to the 1988 TRS and PLEX scores of 8.3 and 7.27, suggesting that the trophic status of the lough has remained relatively stable over the past 26 years. A full list of species is provided in Table 230.

Negative indicator species

Elodea canadensis was found at 52% frequency and frequent abundance. It was also recorded in 1988 with frequent abundance ('3' on a 1-5 scale), suggesting that the species has been an intrinsic part of the lough for at least 26 years. However, its high frequency in productive waters places the lough in unfavourable condition with respect to non-native species.

Macrophyte community structure

Lough Yoan is surrounded by a good marginal zone that consists of wet woodland and a mix of understory and low growing herbs. Dominant species include *Equisetum fluviatile, Filipendula ulmaria, Salix* spp., *Alnus glutinosa, Carex pendula, Carex remota* and *Carex rostrata.* A *Scirpo-Phragmitetum* community fringes the lake itself, consisting of *Phragmites australis, Schoenoplectus lacustris, Equisetum fluviatile, Carex rostrata* and *Sparganium erectum* as most frequent, growing to maximum depths of 1 m. *Nuphar lutea* was frequent in all sections up to 2.3 m, interspersed by *Lemna trisulca* which was abundantly growing within these depths. Less frequent was *Lemna minor,* only to be found in S1 – 3, up to 1.5 m and with rare abundance. *Potamogeton praelongus* was frequent up to a depth of 2.3 m while *Potamogeton crispus* was present in S1 – 3, but most frequent in S1 between depths

of 1.35 – 1.95 m. *Potamogeton natans* was only recorded on the strandline in S3, on the east shore. *Chara globularis* was not present frequently, recorded with sparse growth between 0.75 – 1.95 m depths in S1 – 3 (northern, eastern and southern sides). *Myriophyllum verticillatum* was growing abundantly in all four sections, at a range of depths between 0.5 – 2.6 m, and also at 3.3 m. *Elodea canadensis* was also frequently growing in S1- 4, at depths between 0.25 – 1.4 m. Only one record of *Stratiodes aloides* was noted in S1 at 0.5 m water depth.

Table 227 Aquatic macrophyte community composition for Lough Yoan, including trophic scores.

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=143)***
***Chara* spp.**	**8.5**	**7.69**	**3**	**-**	**-**	**-**
Chara globularis	**-**	**-**	**-**	**8.5**	**7.69**	**7**
Elodea canadensis	8.5	7.95	3	8.5	7.95	52
Fontinalis antipyretica	6.3	5.38	1	-	-	-
Hippuris vulgaris	7.7	7.88	1	-	-	-
Lemna minor	9.0	8.85	2	9.0	8.85	2
Lemna trisulca	10.0	8.85	4	10.0	8.85	80
Myriophyllum spicatum	10.0	8.85	3	-	-	-
Myriophyllum verticillatum	-	-	4	-	-	71
Nuphar lutea	8.5	6.92	4	8.5	6.92	73
Potamogeton crispus	8.5	7.95	4	8.5	7.95	7
Potamogeton natans	6.7	4.23	2	6.7	4.23	+
Potamogeton praelongus	7.3	5.38	3	7.3	5.38	29
Stratiotes aloides	-	-	2	-	-	1
Average score	**8.3**	**7.27**		**8.4**	**7.23**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes taxa recorded as present at the site but not found growing in the survey sections

Water quality

Hard oligo-mesotrophic lakes and ponds typically have clear base-rich water with moderate to low levels of nutrients. Alkalinity at the site appears to be high for the majority of the year, which is consistent with the high pH readings. Water clarity was slightly turbid within the main body of the lake, although clearer within the submerged aquatic plant beds (Z_s = 2.7 m). Total phosphorus is above the level set out in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015), but it appears to have remained relatively stable since the spot water sample taken 1988 (32.0 μgl^{-1}). The lough is therefore considered to be in an 'unfavourable' condition with respect to trophic status. The upper 2.5 m of the water column was well oxygenated (6.6 – 10.05

mgl^{-1}), below which levels dropped off to 1.67 mgl^{-1} at 3.0 m (Figure 50). The mean DO was 8.5 mgl^{-1}.

Table 228 Water chemistry data for Lough Yoan

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1988
TP	18.5	36.9	42.6	34.1	**33.0**	32.0
SRP	2.1	2.1	8.6	3.5	**4.1**	6
TN	0.44	0.77	0.76	0.88	**0.71**	2.49
TON	<0.005	<0.005	0.023	0.168	**<0.050**	0.04
Nitrite	<0.005	<0.005	0.002	0.004	**<0.004**	-
Chl *a*	6.2	1.5	23.2	35.5	**16.6**	6.67
DOC	5.15	7.96	6.96	7.20	**6.82**	-
pH	7.70	8.54	7.75	8.10	**7.92**	7.61
Alk	87	136	138	128	**122**	150
Cond	215	310	318	363	**302**	337
Ca^{2+}	45.7	50.0	48.8	57.1	**50.4**	52.4
Mg^{2+}	3.4	4.4	4.3	4.4	**4.1**	4.4
Na^{+}	10.8	14.1	14.1	16.3	**13.8**	13.5
K^{+}	1.00	1.20	1.47	1.69	**1.34**	0.55
Cl^{-}	13.5	23.4	23.6	30.4	**22.7**	27.4
$SO4^{2-}$	13.6	7.4	7.7	28.2	**14.3**	11.0

Hydrology

Lough Yoan does not have any obvious inflow or outflow streams and is assumed to be groundwater fed. The hydrological regime at the site appears natural.

Lake substrate

Lough Yoan is situated upon a superficial layer of glacial till, below which is a layer of limestone bedrock. The lake basin is predominantly silty, with marginal substrates along the southern shore comprising of fen-derived root mass. Submerged plants were slightly encrusted with calcium carbonate deposits, but the site did not have the rich marl deposits normally associated with this lake type.

Sediment load

The dominant land cover in the catchment is broadleaf woodland, with some improved grazing to the northeast and southwest. There was no evidence of increased sediment loads to the lough.

Indicators of local distinctiveness

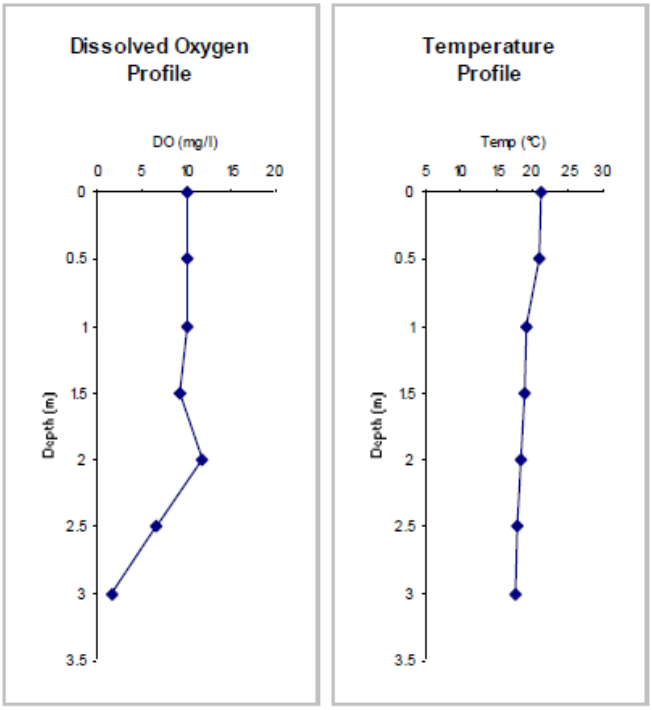
Lough Yoan does not have the dense *Chara* beds normally associated with marl lakes, but the species list has remained almost the same as that recorded in 1988, with no loss in characteristic species. The site is a stronghold for *Myriophyllum verticillatum* which is relatively scarce in Northern Ireland and confined mainly to Fermanagh with the majority of records from ditch systems rather than open water loughs (Forbes & Northridge 2012). This population, which appears to have remained stable since 1988 is therefore considered to be important.

Figure 50 Dissolved oxygen and temperature profile for Lough Yoan (01/07/2014)

Dissolved Oxygen Profile

GPS Location	H2530142343
Maximum Depth (m)	3.3 m
Secchi Depth (cm)	270 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	10.05	21.3
0.5	10.04	20.9
1	10.2	19.2
1.5	9.37	18.9
2	11.8	18.5
2.5	6.6	18
3	1.67	17.7



Summary

Lough Yoan is classed as being in **unfavourable condition**. Charophytes, which are considered to be the primary characteristic species of such hard oligo-mesotrophic lakes, were recorded at low frequency and appear to have declined since the 1988 (NILS) survey which recoded charophytes as being frequent ("3" on a 1-5 scale). Only *Chara globularis* was present at the site. Total phosphorus is above the level set out in the CSM guidelines for this lake type (15 $\mu g l^{-1}$ JNCC 2015), which is similar to the value recorded in 1988, suggesting that the water quality is at least stable with respect to nutrients. *Elodea canadensis* is a persistent element of the site and was recorded growing in dense beds which would otherwise have been potential habitat for charophytes. The established presence of this non-native species is unfavourable. Despite being in unfavourable condition, Lough Yoan supports some notable plant species, particularly *M. verticillatum* and *P. praelongus*, and appears to be relatively stable in terms of both its plant community and nutrient status. The site is well buffered by the surrounding woodland and there was no evidence of any direct anthropogenic impact.

Table 229 Lough Yoan: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Yoan NI Lake 763	**Unfavourable**	Decrease of charophyte abundance since 1988. More than 50% *Elodea canadensis.* TP concentrations exceed CSM target levels.	One species of charophyte (*C. globularis*) present at the site at low frequency. The lough is notable for the presence of *M. verticillatum* and appears to be stable in terms of nutrient status (albeit above CSM target).

Species list

Table 230 List of all plant species recorded at Lough Yoan

Marginal & Emergent species	**Abundance (DAFOR)**
Alnus glutinosa	O
Angelica sylvestris	R
Caltha palustris	R
Carex paniculata	R
Carex pendula	R
Carex remota	O
Carex rostrata	O
Equisetum fluviatile	A
Filipendula ulmaria	O
Iris pseudacorus	R
Lysimachia vulgaris	R
Mentha aquatica	R
Phalaris arundinacea	R
Phragmites australis	F
Salix sp.	F
Schoenoplectus lacustris	F
Sparganium erectum	O
Typha latifolia	R
Valeriana officinalis	R
Submerged & floating species	**% Frequency (n = 143)**
Chara globularis	7
Elodea canadensis	52
Lemna minor	2
Lemna trisulca	80
Myriophyllum verticillatum	71
Nuphar lutea	73
Potamogeton crispus	7
Potamogeton praelongus	29
Stratiotes aloides	1
Potamogeton natans	+

Survey data

Site Condition Assessment: Yoan Lough (01/07/2014)

Lake Details		**Survey Details**		
Lake Name	Yoan Lough	Survey Date	01/07/2014	
SSSI Name		Surveyors	BG, SG	
SAC Name		Shore Surveys	4	out of
Grid Ref	H253423	Wader Surveys	4	4
WBID / NI No.	50113 / 763	Boat Surveys	4	sections

Site Notes:

Survey Notes:
3.3m depth - Myro vert growing. V slightly turbid, clearer in plant beds.
P. natans present on East shore

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	220 cm
		Compass bearing of boat transect (°)	330 °
		Lateral distance from waters edge to 75cm depth (m)	8 m
		Notes: 4th transect: overhung by trees. V shaded	
Section	**2**	Maximum depth of colonisation (cm)	230 cm
		Compass bearing of boat transect (°)	20 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**3**	Maximum depth of colonisation (cm)	260 cm
		Compass bearing of boat transect (°)	160 °
		Lateral distance from waters edge to 75cm depth (m)	15 m
		Notes:	
Section	**4**	Maximum depth of colonisation (cm)	220 cm
		Compass bearing of boat transect (°)	10 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H2515342411	H2513042506	H2513042451	H2521242360
Section	**2**	H2534842421	H2543442360	H2538842395	H2538542364
Section	**3**	H2551142020	H2541941990	H2547642004	H2545442062
Section	**4**	H25383432190	H2550042180	H2544142190	H2543642145

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	2506	2507	2519
Section	**2**	2520	2521	2524
Section	**3**	2530	2529	2528
Section	**4**	2531	2532	2533

3.45. Drumacrittin Lough (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	05 July 2014
NI Lake Number:	986
WBID:	50280
County:	Fermanagh
Grid reference:	H549328
OS Grid reference (X,Y):	254895,332805
Shoreline development index:	1.374
Surface area (ha.):	4.0
Maximum recorded depth (m):	5.7

Table 231 Condition Assessment Summary Table for Drumacrittin Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	1 present: *Chara rudis*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	13% of vegetated sample spots comply (15% wader, 0% boat)
	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 11% of vegetated sample sites.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 11% of vegetated sample sites.
	Filamentous Algae (non – *Chara)*: <20% of points scoring '3'	✓	Filamentous algae cover 10.8% on the wader transects only. 0% of points score '3'.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Varied, but species rich emergent zones dominated by *C. rostrata, T. latifolia, S. lacustris* and *E. fluviatile* and *M. trifoliate. Chara* beds extend to >0.75 m and *Nuphar lutea* to 2.6 m. *Chara* beds do not exceed 50% of photic zone (approx. 10%).
	Maximum depth distribution should be maintained	✓	Z_{max} = 5.7 m, Z_{s} = 1.35 m, Z_{v} = 2.8 m
	At least the present structure should be maintained	✓	No change evident.
Water quality	Stable nutrients levels: TP target / limit = 10 μgl^{-1}	**X**	TP = 43.0 μgl^{-1} (range 31.0 – 52.0 μgl^{-1}) & TN = 0.88 mgl^{-1} (April '14 – Feb '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.1 (range = 8.0 – 8.21)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below the thermocline)	**X**	Waters were well oxygenated to 3.0 m (7.41 mgl^{-1}), below which levels dropped off to a mean of 0.22 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial blooms or excessive algal growth reported. Turbid brown-green water.
Hydrology	Natural hydrological regime	✓	Natural shoreline maintained.
Lake substrate	Natural shoreline maintained	✓	No evidence of change.
	Natural and characteristic substrate maintained	✓	Natural and characteristic substrate maintained.
Sediment load	Natural sediment load maintained	✓	No evidence of increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	**X**	*C. rudis* is classified as near threatened – abundance has decreased since 2006.
	Minimal negative impacts	✓	Slight disturbance from human pressures – shore angling evident.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 4.0 ha, with no loss of extent of open water.

Macrophyte community composition

Although Drumacrittin Lough has the nationally threatened *Chara rudis* present, the aquatic macrophyte assemblage is otherwise poor for this lake type and the overall frequency of *Chara* spp. has declined since 2006 with the loss (or significant reduction) of *Chara hispida* (recorded in 2006 but was not observed in the 2014). *C. rudis,* a nationally threatened species, was only recorded with a 9% total occurrence in 2006, which has remained the same in 2014.

Myriophyllum spicatum, *Potamogeton berchtoldii* and *P. obtusifolius* were recorded in 1989 but were not observed in 2006 or 2014. *P. alpinus* was recorded in both 1989 and 2006, but not in 2014. *P. lucens was* however recorded in the site in 2014. *Elodea canadensis* has remained stable since it was first recorded in 2006. All other species, including *Fontinalis antipyretica* and *Utricularia vulgaris* were recorded in both surveys. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 7.9 and 7.29 respectively (Table 232), which are similar to the 2006 TRS and PLEX scores of 7.8 and 6.99.

Table 232 Aquatic macrophyte community composition for Drumacrittin Lough, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=58)***	**TRS**	**PLEX**	**% occurrence (n=66)***
Chara hispida	**8.5**	**7.69**	**29**	**-**	**-**	**-**
Chara rudis	**8.5**	**7.69**	**9**	**8.5**	**7.69**	**9**
Elodea canadensis	8.5	7.95	10	8.5	7.95	11
Fontinalis antipyretica	6.3	5.38	33	6.3	5.38	42
Hippuris vulgaris	-	-	-	7.7	7.88	2
Lemna minor	9.0	8.85	2	9.0	8.85	2
Lemna trisulca	10.0	8.85	64	10.0	8.85	26
Menyanthes trifoliata	-	-	-	5.3	-	9
Nuphar lutea	8.5	6.92	50	8.5	6.92	61
Potamogeton alpinus	5.5	5.38	2	-	-	-
Potamogeton lucens	-	-	-	10.0	7.88	2
Utricularia vulgaris	5.5	4.23	12	5.5	4.23	29
Average score	**7.8**	**6.99**		**7.9**	**7.29**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was found at 11% frequency. It was first recorded in 2006 at 10% frequency, suggesting that it has colonised the site relatively recently. The current nutrient conditions are likely to give this species a competitive advantage over the characteristic aquatic flora. No other negative indicators were found.

Macrophyte community structure

Drumacrittin Lough is surrounded by improved and semi-improved pasture with areas of mixed woodland. The marginal vegetation is varied with species rich emergent zones dominated by *Agrostis stolonifera, Alnus glutinosa, Carex rostrata* and *Epilobium palustre* on the southeast bank and a similar community along the northwest bank, with *Juncus effuses, Juncus inflexus, Equisetum fluviatile* and *Typha latifolia* as additional species. Beds of *N. lutea* fringe the lough, up to 2.6 m depth, whilst *Utricularia vulgaris* (0.5 – 1.8 m) is abundant along the lough margins. It is estimated that the *Chara* beds extended over only 10% of the photic zone. This fall below the expectation for this lake type.

Water quality

The water chemistry of Drumacrittin Lough is mostly typical of hard oligo-mesotrophic lakes, with base-rich waters and high pH. The water was turbid (brown-green) during the 2014 survey and the mean annual total phosphorus was well above the upper limit set out in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015) and is higher than the TP concentration recorded in 2006 (34 μgl^{-1}), suggesting the site may have become enriched in recent years. On average, Chl *a* concentrations exceeded the guide concentrations suggested in the REBECCA report (9-15 μgl^{-1}) by Phillips (2005) for this lake type. The lough is therefore considered to be in unfavourable condition with respect to trophic status. The upper 3.0 m of the water column was well oxygenated (> 7.41 mgl^{-1}), declining to a mean score of 0.22 mgl^{-1} below the thermocline (3.25 m depth) (Figure 51).

Table 233 Water chemistry data for Drumacrittin Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1989
TP	43.0	52.6	31.0	45.3	43.0	34.0	16
SRP	0.001	0.001	0.001	0.005	0.002	-	2
TN	0.8	0.9	1.0	0.8	0.9	0.7	0.68
TON	0.005	0.005	0.155	0.005	0.043		-
Nitrite	0.001	0.001	0.003	0.001	0.001	-	-
Chl a	16.3	37.8	48.0	24.0	31.5	15.2	7.18
DOC	6.4	5.9	6.4	6.2	6.2	-	-
pH	8.0	8.1	8.2	8.2	8.1	7.9	8
Alk	185	185	176	227	193	61.1	83.0
Cond	366.0	364.0	391.0	432.0	388.3	357.8	325
Ca^{2+}	71.7	68.2	79.2	92.0	77.8	73.9	50
Mg^{2+}	4.6	4.4	4.1	4.6	4.4	3.5	3.8
Na^{+}	6.4	6.2	6.2	6.5	6.3	5.4	3.7
K^{+}	1.9	2.1	2.0	2.1	2.0	2.0	0.35
Cl^{-}	12.1	12.3	12.5	12.2	12.3	8.3	10.4
SO_4^{2-}	8.4	9.1	16.6	12.9	11.7	24.8	13.3

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

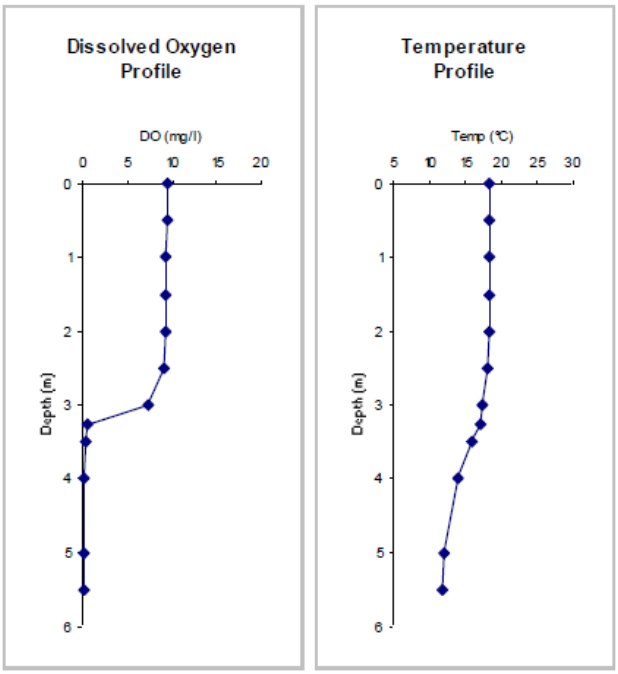
The lake basin is predominantly silty with marginal substrates comprising of organic material and root mats within the reed beds. Marl deposits were evident on submerged plants, and to a lesser extent in the sediments.

Figure 51 Dissolved oxygen and temperature profile for Drumacrittin Lough (05/07/2014)

Dissolved Oxygen Profile

GPS Location	H5489632837
Maximum Depth (m)	5.7 m
Secchi Depth (cm)	135 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	9.51	18.3
0.5	9.45	18.3
1	9.41	18.3
1.5	9.4	18.3
2	9.36	18.3
2.5	9.1	18
3	7.41	17.4
3.25	0.59	17.1
3.5	0.4	15.9
4	0.12	14.1
5	0.14	12.1
5.5	0.22	11.9



Sediment load

Disturbance to the site appears to be relatively low and no evidence of increased sediment loads to the lough was noted from the catchment. There is an area of open reeds on the eastern shore where cattle drink resulting in light poaching of the shore, but disturbance is relatively low and there was minimal effect to the sediment loading to the lough. No further evidence of increased sediment load was noted from the catchment.

Indicators of local distinctiveness

The nationally threatened *Chara rudis* (Stewart, 2004) is present at the site.

Summary

Just one *Chara* species was recorded, the rare *Chara rudis,* which appears to have remained stable since it was last recorded in 2006. The charophyte beds only covered about 10% of the photic zone however and were therefore not well represented in the open water regions of the site. The nutrient levels were above the CSM target value for this lake type (10 μgl^{-1} JNCC 2015). Furthermore, TP levels

appear to have increased since 2006 and high Chl *a* concentrations indicate periods of poor water clarity throughout the lough. Average levels of dissolved oxygen beneath the thermocline fell below the 2015 CSM target value of >7 mgl^{-1}. *Elodea canadensis* appears to have recently colonised the lough but has stabilised since its first recording in 2006. Any further increase in abundance would further compromise the condition of the site. The lough does not achieve the requisite features for favourable condition, since the charophyte flora are becoming further impoverished and are in danger of diminishing. Drumacrittin Lough is therefore considered to be in **unfavourable condition**. The high nutrients and the diminishing populations of charophyte are considered inappropriate for the site, and it is recommended that the nutrient sources are identified and if possible remedial action taken to prevent further enrichment.

Table 234 Drumacrittin Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Drumacrittin Lough NI Lake 986	**Unfavourable**	Very low (decreasing) *Chara* frequency. Nutrient enrichment at site and TP exceeds threshold. Low dissolved oxygen values beneath thermocline.	Investigate nutrient sources. Less intensive agriculture around the lake shore would be beneficial. This site is notable for the presence of *Chara rudis.*

Species list

Table 235 List of all plant species recorded at Drumacrittin Lough: 2015

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	F
Alnus glutinosa	F
Angelica sylvestris	R
Caltha palustris	R
Carex rostrata	F
Cicuta virosa	R
Epilobium hirsutum	R
Epilobium palustre	R
Equisetum fluviatile	F
Equisetum palustre	R
Filipendula ulmaria	F
Galium palustre	R
Juncus acutiflorus	R
Juncus effusus	R
Juncus inflexus	R
Mentha aquatica	R
Menyanthes trifoliata	O
Phalaris arundinacea	R
Potentilla anserina	F
Potentilla palustris	R
Salix sp.	F
Typha latifolia	F
Veronica anagallis-aquatica	R
Submerged & floating species	**% Frequency (n = 66)**
Chara rudis	9
Elodea canadensis	11
Fontinalis antipyretica	42
Hippuris vulgaris	2
Lemna minor	2
Lemna trisulca	26
Menyanthes trifoliata	9
Nuphar lutea	61
Potamogeton lucens	2
Utricularia vulgaris	29

Survey data

Site Condition Assessment: Drumacrittin Lough (05/07/2014)

Lake Details		Survey Details		
Lake Name	Drumacrittin Lough	Survey Date	05/07/2014	
SSSI Name		Surveyors	SG, EA	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H549328	Wader Surveys	2	2
WBID / NI No.	50280 / 986	Boat Surveys	2	sections

Site

new end

Survey

S2: Previous GPS points seem to be wrong so set

point 100m from start point

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	260 cm
		Compass bearing of boat transect (°)	315 °
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes: Chara A & B - dense matt @75cm.	
Section	**2**	Maximum depth of colonisation (cm)	280 cm
		Compass bearing of boat transect (°)	135 °
		Lateral distance from waters edge to 75cm depth (m)	-
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H5478732926	H5483532845	H5481832889	H5484132879
Section	**2**	H5491032642	H5499332707	H5496332659	H5494932681

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0022	0015	0023
Section	**2**	0020	0019	0021

3.46. Annachullion Lough (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

Survey Date	02 July 2014
NI Lake Number:	997
WBID:	50545
County:	Fermanagh
Grid reference:	H519302
OS Grid reference (X,Y):	251913,330242
Shoreline development index:	1.2
Surface area (ha.):	1.25
Maximum recorded depth (m):	3.8

Table 236 Condition Assessment Summary Table for Annachullion Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	2 present: *C. virgata* and *C. rudis*.
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	**X**	1% of vegetated sample spots comply.

Attribute	Target	Status	Comment
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*M. spicatum* at c. 50 % - increased cover suggests trophic change.
	Non-native species absent or present at low frequency	✓	No non-natives recorded.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	No sample plots had significant growths of filamentous algae.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Varied, but species rich emergent zones (*P. australis, S. lacustris, C. rostrata, Carex elata, Cladium mariscus*). Several small patches of *Chara sp.* in the margins, much reduced from 2006. Lack of extensive *Chara* beds is unfavourable
	Maximum depth distribution should be maintained	**X**	Z_{max} = 3.8 m, Z_{s} = 2.65 m, Z_{v} = 3.4 m – but reduced *Chara* cover
	At least the present structure should be maintained	**X?**	Secchi depth and maximum depth of colonisation reduced since 2006.
Water quality	Stable nutrients levels: TP target / limit = 10 μgl^{-1}	**X**	TP = 23 μgl^{-1} (range 9 – 35 μgl^{-1}) & TN = 1.61 mgl^{-1} (Apr'14 – Feb'15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.08
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	**X**	Surface water well oxygenated, but dropping to mean DO of 0.75 mgl^{-1} below the thermocline at 2.5 m.
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial blooms or excessive algal growth reported.
Hydrology	Natural hydrological regime	**✓?**	Natural shoreline maintained. Some recent drainage work close to east shore.
Lake substrate	Natural shoreline maintained	**✓?**	Some recent clearance of marginal scrub and ditch and shore modification. Small area affected.
	Natural and characteristic substrate maintained	✓	Natural and characteristic substrate maintained.
Sediment load	Natural sediment load maintained	✓	No evidence of increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	**X**	The nationally scarce *Chara aculeolata* and the rare *P. coloratus* both recorded in 2006, but were not present in this survey.

Attribute	Target	Status	Comment
	Minimal negative impacts	✓?	Localised marginal land management may be detrimental to the lake.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.25 ha, with no loss of extent of open water.

Macrophyte community composition

Table 237 Aquatic macrophyte community composition for Annachullion Lough, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=62)***	**TRS**	**PLEX**	**% occurrence (n=77)***
Chara aculeolata	**8.5**	**7.69**	**5**	**-**	**-**	**-**
Chara globularis	**8.5**	**7.69**	**23**	**-**	**-**	**-**
Chara hispida	**8.5**	**7.69**	**69**	**-**	**-**	**-**
Chara virgata	**8.5**	**7.69**	**31**	**8.5**	**7.69**	**1.3**
Chara rudis	**8.5**	**7.69**	**16**	**8.5**	**7.69**	**1.3**
Lemna trisulca	10	8.85	2	-	-	-
Menyanthes trifoliata	5.3	-	6	5.3	-	6.5
Myriophyllum spicatum	10.0	8.85	3	10.0	8.85	49.4
Nitella flexilis agg.	5.5	5.38	13	-	-	-
Nuphar lutea	8.5	6.92	50	8.5	6.92	49.4
Nymphaea alba	6.7	3.08	13	6.7	3.08	50.6
Potamogeton natans	6.7	4.23	21	6.7	4.23	18.2
Utricularia vulgaris agg. (U. australis?)	5.5	4.23	24	-	-	-
Average score	**7.7**	**6.46**		**7.7**	**6.41**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

In 2006 Annachullion Lough had a characteristic aquatic macrophyte assemblage with at least five *Chara* species recorded; *Chara hispida, C. virgata, C. globularis,* the nationally scarce *Chara aculeolata* and the nationally threatened *Chara rudis*. The situation in 2014 is vastly different; only 2 *Chara* species were recorded (*Chara rudis* & *Chara virgata*) in less than 5% of all sampled plots. *Myriophyllum spicatum* now dominates in the zone inhabited by *Chara spp.* in 2006, where it was recorded in 49.4% of all sampled plots compared to only 3% in 2006. As well as the absent *Chara spp*., four other aquatic macrophyte taxa were not recorded in 2014 that were

present in 2006:*Lemna trisulca*, *Nitella flexilis agg.*, *Utricularia sp*. and *P. coloratus*, the latter being rare in NI.

Despite this large shift in community composition the mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were very similar to 2006 and 1988. The 1988 survey of Annachullion Lough recorded charophytes as abundant ("4" on a 1-5 scale) but did not specify which species were present, except for *Chara globularis* var. *virgata* and *C. hispida.* The latter was the most frequently occurring charophyte species in the 2006 survey. *Potamogeton lucens* was recorded in 1988 but was not observed in 2006 or 2014, whilst *Potamogeton natans* was only observed in 2006 & 2014. The rare species *Potamogeton coloratus* was found growing in the marginal vegetation in 2006 but was not recorded in 2014. It was only located at 1 sample point in 2006, so could easily be missed in subsequent surveys.

Negative indicator species

No negative indicator or non-native species were found.

Macrophyte community structure

Annachullion Lough is surrounded by reeds dominated by *Carex rostrata, Carex elata, Schoenoplectus lacustris* and *Phragmites australis* with broadleaf woodland and managed pasture beyond. Beds of *N. lutea and N. alba* fringed the lough, up to 3.6 m depth, whilst *Potamogeton natans reached* up to 1.5 m depth. *M. spicatum* dominated the submerged zone from 0.75m to 3.5m deep (present in 76% of all plots in the boat survey) an area previously rich with charophytes. It can be hypothesised that either *M. spicatum* has outcompeted *Chara spp.* in this zone, or that the presence of *M. spicatum* reduces the efficiency of the grapnel rake in picking up *Chara spp.* as the elongated stems tangle with the rake and stop the rake running along the lake bed. While the latter is possible, it is unlikely that large *Chara* spp. beds were present under the dense canopy of *M. spicatum.*

Water quality

The water chemistry of Annachullion Lough is typical of hard oligo-mesotrophic lakes and ponds, having clear, base-rich water with a moderate nutrient level. Total phosphorus is above the target level set out in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015), and has increased since the 2006 survey. Total nitrogen levels have also increased significantly from $0.8 mgl^{-1}$ in 2006 to $1.61 mgl^{-1}$ in 2014, and thus exceed the CSM limit set at 1.5 mgl^{-1}. This figure is one of the highest TN values for all the lakes sampled in Northern Ireland in 2014 as part of this project. The drivers of Chara presence/absence in marl lakes is complex but factors such as high TN and/or TP have been shown to reduce Chara spp. diversity and abundance (Wiik *et al*. 2013). There is no excessive filamentous algal growth and while chlorophyll a remain relatively low, values have nonetheless increased since the 2006 survey. The lough is therefore considered to be in unfavourable condition with respect to trophic status. The water chemistry data is broadly similar to those values derived from a spot water sample taken on the 01/08/1988 and from the 2006 survey, although some notable trends are apparent. Alkalinity, calcium and conductivity have all increased over time; the reason for this is unclear however. The upper 2.0 m of the water column was well oxygenated (> 5 mgl^{-1}), declining to 0.5 mgl-1 at 3.5 m. (Figure 52).

Table 238 Water chemistry data for Annachullion Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	2006	1988
TP	35	9	29	20	**23**	16	13
SRP	2.7	1	1.8	3.6	**2**	n/a	9
TN	1.57	0.69	1.12	3.04	**1.61**	0.80	0.9
TON	0.8	<0.005	0.394	2.45	**<0.91**	n/a	-
Nitrite	0.016	<0.001	0.002	0.021	**<0.01**	n/a	-
Chl *a*	16.61	2.51	7.81	7.85	**8.70**	4.10	0.8
DOC	9.90	10.20	9.55	10.20	**9.96**	n/a	-
pH	8.24	8.08	8.02	8.03	**8.08**	7.90	8.02
Alk	243	250	241	218	**238**	156.60	101
Cond	492	495	476	487	**487**	459	388
Ca^{2+}	102.0	104.0	95.3	102.0	**100.8**	79.3	66.6
Mg^{2+}	4.25	4.37	4.08	4.06	**4.19**	3.10	3.95
Na^{+}	8.06	7.62	7.43	8.39	**7.88**	7.80	6.55
K^{+}	3.60	2.74	3.12	3.85	**3.33**	2.40	1
Cl^{-}	18.5	17.0	17.0	18.5	**17.75**	9.4	16.2
SO_4^{2-}	17.7	16	18.8	26.1	**19.7**	23.70	14.6

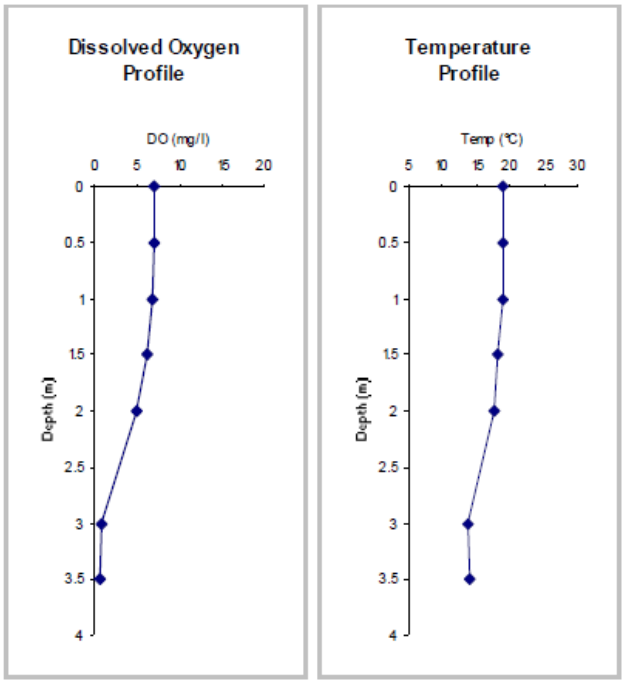
Figure 52 Dissolved oxygen and temperature profile for Annachullion Lough (02/07/2014)

Dissolved Oxygen Profile

GPS Location	H5194230250
Maximum Depth (m)	3.8 m
Secchi Depth (cm)	265 cm

Notes: Windy so hard to stay still even with anchor

Depth (m)	DO (mg/l)	Temp (°C)
0	7.04	18.9
0.5	7.05	18.9
1	6.9	18.8
1.5	6.2	18.1
2	5	17.7
3	0.92	13.7
3.5	0.6	13.9



Hydrology

The hydrological regime at the site appears natural.

Lake substrate
The lake basin is predominantly silty with marginal substrates comprising mainly organic material and mats of reed roots.

Sediment load
Disturbance to the site appears to be relatively low, although a field bordering the lough has been recently cleared of scrub and a land drain has been dug which enters the lough. This may impact sediment load.

Indicators of local distinctiveness
Annachullion Lough is a good example of a marl lake but recent survey data suggests that it is much degraded. The nationally threatened *Chara rudis* (Stewart, 2004) is still present at the site but at a very low abundance. The rare Fen Pondweed, *Potamogeton coloratus,* recorded in 2006 was absent in the 2014 survey.

Summary
Annachullion Lough is classified as being in an **unfavourable condition** and although it has been described as good example of a species rich, *Chara* dominated marl lough, current data shows that this is no longer the case. Five *Chara* species were recorded in 2006, including the nationally scarce *Chara aculeolata* and the nationally threatened *Chara rudis.* This list has been reduced to two species in 2014; *C. rudis* and *Chara virgata*, which are present in much lower abundance than in 2006. *Myriophyllum spicatum* now dominates in the zone inhabited by *Chara spp.* in 2006. The water chemistry is typical of hard oligo-mesotrophic lakes and ponds, having clear, base-rich water but the nutrient levels now exceed the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015) and Chlorophyll *a* amounts have increased. All the above information indicates at nutrient enrichment at the site. There also appears to be some marginal disturbance to the site where a scrub field has been cleared and drained. Due to the importance of this site it is recommended that a repeat survey is performed with a snorkel survey to confirm the decline of *Chara spp.* at this site. Additional monitoring of water quality and potential nutrient sources in the catchment are also recommended as a minimum requirement.

Table 239 Annachullion Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Annachullion Lough NI Lake 1135	**Unfavourable**	Loss of 3 *Chara* species and reduction in abundance of the remaining 2. Increase in *M. spicatum* to 50% frequency. TP levels exceed CSM guidelines.	A once good example of a *Chara* dominated marl lough, now much degraded. Assessed as favourable in 2006, but now falls well below the CSM criteria for this site type. Further monitoring of the flora and nutrient sources is recommended.

Species list

Table 240 List of all plant species recorded at Annachullion Lough

Marginal & Emergent species	Abundance (DAFOR)
Salix sp.	F
Schoenoplectus lacustris	O
Phragmites australis	O
Carex elata	O
Cladium mariscus	R
Potentilla palustris	R
Carex rostrata	R
Alnus glutinosa	R
Equisetum fluviatile	R
Valeriana officinalis	R
Juncus effusus	R
Menyanthes trifoliata	R
Typha latifolia	R
Mentha aquatica	R
Equisetum arvense	R
Submerged & floating species	**% Frequency (n = 77)**
Chara virgata	1.3
Chara rudis	1.3
Menyanthes trifoliata	6.5
Myriophyllum spicatum	49.4
Nuphar lutea	49.4
Nymphaea alba	50.6
Potamogeton natans	18.2

Survey Data

Site Condition Assessment: Annachullion Lough (02/07/2014)

Lake Details		**Survey Details**		
Lake Name	Annachullion Lough	Survey Date	02/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H519302	Wader Surveys	2	2
WBID / NI No.	50545 / 997	Boat Surveys	2	sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	330 cm
		Compass bearing of boat transect (°)	348 °
		Lateral distance from waters edge to 75cm depth (m)	2 m
		Notes: Not sure why 1d in wader survey has no data?	
Section	**2**	Maximum depth of colonisation (cm)	350 cm
		Compass bearing of boat transect (°)	203 °
		Lateral distance from waters edge to 75cm depth (m)	2 m
		Notes: Windy	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H5182730258	H5192130306	H5187630264	H5189930243
Section	**2**	H5198430200	H5188630200	H5193230254	H5194230253

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0149	0148	0147
Section	**2**	0157	0158	0150

3.47. Kilroosky Lough (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	30 June 2014
NI Lake Number:	1005
WBID:	50315
County:	Fermanagh
Grid reference:	H495274
OS Grid reference (X,Y):	249362,327387
Shoreline development index:	1.600
Surface area (ha.):	3.75
Maximum recorded depth (m):	5.1

Table 241 Condition Assessment Summary Table for Kilroosky Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	*6 present: Chara aculeolata, Chara contraria, Chara globularis, Chara hispida, Chara rudis, Chara virgata*
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	✓	75% of vegetated sample spots comply (75% wader, 75% boat), but mainly very sparse and in poor condition.
	Negative indicator species absent or at low frequency	✓	*Elodea canadensis* present at low frequency.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present, but low frequency and recorded in NILS 1988.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	10% of plots with '3' - Filamentous algae at higher frequency and abundance than 2006.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Varied, but species rich emergent zones (*P. australis, S. lacustris, C. rostrata, Cladium mariscus, M. aquatica*). Open water areas were without beds of Chara spp. *P. natans* increased. Major decline in depth distribution and frequency since 2006.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 5.1 m, Z_{s} = 1.38 m, Z_{v} = 3.1 m. Decline in water clarity and max. depth of colonisation since 2006
	At least the present structure should be maintained	**X**	Marginal areas remain stable, but major decline in submerged and characteristic species.
Water quality	Stable nutrients levels: TP target / limit = 10 μgl^{-1}	**X**	TP = 48.1 μgl^{-1} (32 – 56 μgl^{-1}) & TN = 0.88 mgl^{-1} (April '14 – Feb '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.06 (range = 7.9 – 8.2)
	Adequate dissolved O_2 throughout the water column (mean > 7mgl^{-1} below thermocline)	**X**	Waters were well oxygenated to c. 4.0 m (8.0 mgl^{-1}), below which levels dropped off to < 1.5 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	**X**	Major cyanobacterial bloom in Feb. 15 and site turbid/ green in June 2014. Chl *a* 60.9 ugl^{-1}
Hydrology	Natural hydrological regime	✓	Appears natural – see text
Lake substrate	Natural shoreline maintained	✓	Mainly natural. New angling platforms installed on RoI shore..
	Natural and characteristic substrate maintained	**?**	Unlikely to precipitate carbonate under current conditions.
Sediment load	Natural sediment load maintained	**?**	Unknown. High algal turbidity likely to increase sedimentation Catchment land cover is mainly rough pasture, with no evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	**X**	Charophyte beds much reduced and in poor condition and water turbid.
	Minimal negative impacts	**X**	Significant increase in P loadings to the lough.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 3.75 ha, with no loss of extent of open water.

Macrophyte community composition

Six species of stonewort (*Chara* spp.) species were recorded in the 2014 survey of Kilroosky Lough, which in terms of species present, was identical to the 2006 survey: *Chara aculeolata, C. hispida, C. contraria, C. globularis, C. virgata and C. rudis* (nationally threatened). Whilst this represents an impressive species list, the distribution and condition of the charophytes was very poor, with the majority of plants occurring in sparse beds and generally degraded and without fresh growth. In addition to the characteristic species, *Utricularia vulgaris* agg., *Potamogeton natans*, *L. trisulca* and *Lemna minor* were common and showed an increase in frequency since 2006 (Table 242). Other species recorded were *Nuphar lutea, Nymphaea alba* and a few individual plants of *Elodea canadensis* which was found at the site 1989, but not in 2006.

Table 242 Aquatic macrophyte community composition for Kilroosky Lough, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=66)***	**TRS**	**PLEX**	**% occurrence (n=68)***
Chara aculeolata	**8.5**	**7.69**	**39**	**8.5**	**7.69**	**1**
Chara contraria	**8.5**	**7.69**	**5**	**8.5**	**7.69**	**8**
Chara globularis	**8.5**	**7.69**	**38**	**8.5**	**7.69**	**1**
Chara hispida	**8.5**	**7.69**	**83**	**8.5**	**7.69**	**13**
Chara rudis	**8.5**	**7.69**	**26**	**8.5**	**7.69**	**10**
Chara virgata	**8.5**	**7.69**	**9**	**8.5**	**7.69**	**5**
Elodea canadensis	-	-	-	8.5	7.95	2
Lemna minor	-	-	-	9	8.85	26
Lemna trisulca	-	-	-	10	8.85	10
Menyanthes trifoliata	-	-	2	5.3	-	79
Nitella flexilis	5.5	5.38	+	5.5	5.38	24
Nuphar lutea	8.5	6.92	5	8.5	6.92	10
Nymphaea alba	-	-	-	6.7	3.08	
Potamogeton natans	6.7	4.23	3	6.7	4.23	66
Utricularia vulgaris agg.	**5.5**	**4.23**	**18**	**5.5**	**4.23**	**31**
	7.7	**6.69**		**7.8**	**6.94**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys.

The 1989 survey of Kilroosky Lough recorded charophytes as dominant (“5” on a 1-5 scale – only identifying *C. hispida* to species level). In 2006, the *Chara* species

assemblage was the same, but they were found at greater depths and in many places formed dense *Chara* “lawns” which were not recorded in 2014. The relatively high frequency of *Utricularia vulgaris* agg. was resulted in compliance with the 70% target frequency for characteristic species, *Chara* spp. fell well short of this.

The current flora is **unfavourable condition** due to a major deterioration in the frequency and abundance of *Chara* spp., although no loss of species has occurred.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 7.8 and 6.94 respectively (Table 242), which are similar to the 1989 and 2006 scores.

Negative indicator species

Elodea canadensis was found at 2% frequency and although not seen in 2006, it was present at the site at low abundance in 1989 (NILS) and is therefore not a recent colonist at the site. High nutrients may potentially favour this species and any significant increase would detract from the availability of habitat for *Chara species.*

Macrophyte community structure

Kilroosky Lough is fringed by mixed reed beds, dominated by *P. australis* with *c. rostrata, S. lacustris* and *C. mariscus* common. Around much of the lough is a band of *Salix* and *Betula* scrub with wet meadow and rough pasture beyond. *Nymphaea alba* and *Nuphar lutea* are relatively rare in the survey but are relatively common along the eastern fringe and in a number of small discrete beds around the site. *Lemna minor* and *L. trisulca* were recorded mainly within the reeds and at the reed face. *Potamogeton natans* was sparse and in very poor condition, but relatively frequent in the eastern arm to a depth of 3.1 m. *Utricularia vulgaris* agg. was also sparse, but relatively frequent and occurred to depths of 3.1 m.

Charophytes were not uncommon in the site, but they rarely amounted to more than a few scraps on the grapnel and the site was without the dense and extensive beds seen in 2006. Furthermore the maximum depth of colonisation for *Chara* spp was only 2.8 m compared to 4.2 m in 2006. *Chara hispida* was the most abundant stonewort, but where it occurred at its maximum (section 2 on the NW of the site) it was in very poor condition and showed little evidence of active growth. The majority of *Chara spp.* were in equally poor condition.

Despite still having excellent marginal vegetation, Kilroosky Lough has shown a significant deterioration in the submerged macrophyte structure, which no longer meets CSM targets and is therefore deemed as unfavourable

Water quality

The water chemistry of Kilroosky Lough is typical of hard oligo-mesotrophic lakes in terms of pH and alkalinity and it has relatively high ionic content (Table 243). In contrast to the excellent water quality seen in the past however, total phosphorus was well above the limit set out in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2005) and algal biomass reached exceptionally high levels, particularly in autumn and winter, when the site became highly turbid and green. These findings are similar to the conditions seen in 2013, which again saw very high levels of TP and high winter algal biomass (Rolston & McCarthy 2014)

This switch from the clear-water condition with benthic production seen in 2006 to turbid water dominated by planktonic algae represents a major downturn in water quality and is of major concern for this SAC site. There are no obvious sources of nutrient pollution reaching the lake via surface water run-off, and it is therefore likely that the complex geology and hydrology of the area (Rolston & McCarthy 2014) is delivering nutrient to the site via the ground water supply. The reason for the change in status since 2006 is unknown and it is recommended that the source of these nutrients be traced as a matter of urgency. Recovery of the site is more likely if the nutrient pollution can be stopped while the site still has some resilience in terms of species richness and viability.

The upper 2.5 m of the water column was well oxygenated (> 6.85 mgl^{-1}), rapidly declining to <0.5 mgl^{-1} at depths greater than 3.5 m (Figure 53).

Table 243 Water chemistry data for Kilroosky Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	2006	1989
TP	55.1	31.8	48.9	56.4	**48.1**	12.0	10.0
SRP	12.1	1.1	1.4	1	**3.9**		
TN	0.72	0.99	1.01	0.79	**0.88**	0.8	0.3
TON	0.005	0.005	0.034	0.005	**0.012**		
Nitrite	<0.001	<0.001	0.001	<0.001	**<0.001**	-	-
Chl *a*	10.6	7.7	60.6	164.6	**60.9**	6.8	2.6
DOC	7.17	7.45	6.94	6.45	**7.00**		
pH	8.18	7.92	8.08	8.12	**8.06**	7.7	8.1
Alk	233	199	259	186	**219**	124.4	82.0
Cond	462	413	407	395	**419**	323	323.0
Ca^{2+}	92.3	79.4	74	82.3	**82**	65.4	47.6
Mg^{2+}	4.83	4.93	4.91	4.36	**4.75**	9.8	3.6
Na^{+}	9.7	9.5	9.45	9.46	**9.53**	8.6	4.2
K^{+}	1.73	1.61	1.89	2.10	**1.83**	1.4	0.0
Cl^{-}	18.8	17.8	19.2	17.3	**18.3**	8.4	10.6
SO_4^{2-}	14	11.9	11.6	15.6	**13.3**	17.7	7.0

Hydrology

The hydrological regime at the site appears stable. The outflow was in the south-eastern corner was cleared in the 1990s, which lowered the water level by about 30cm (Tony Waterman, pers. comm.). The site has since stabilised. Ground water has been demonstrated to contribute significantly to the water supply of Kilroosky (Rolston & McCarthy 2014) and therefore nutrient budgeting and identification of any nutrient inputs becomes extremely complex. It is nonetheless recommended that a comprehensive survey of the groundwater hydrology is undertaken to establish the source of nutrients to the site.

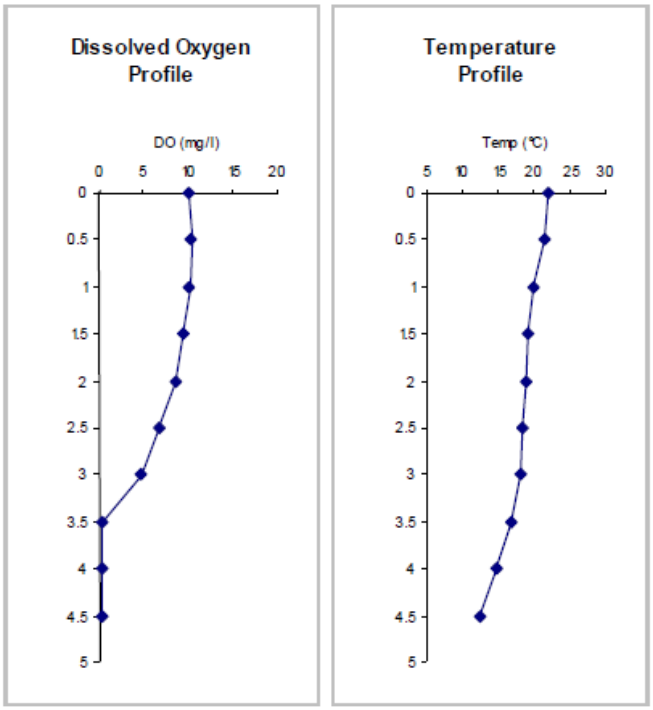
Figure 53 Dissolved oxygen and temperature profile for Kilroosky Lough (30/06/2014)

Dissolved Oxygen Profile

GPS Location	H4931127357
Maximum Depth (m)	5.1 m
Secchi Depth (cm)	138 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	10.13	22.1
0.5	10.25	21.4
1	10.06	19.9
1.5	9.45	19.2
2	8.59	18.8
2.5	6.85	18.5
3	4.64	18.2
3.5	0.5	16.8
4	0.46	14.7
4.5	0.5	12.6



Lake substrate

The lake basin is predominantly organic and silty with only limited evidence of marl deposits noted. The carbonate deposition normally associated with this lake type is likely to have ceased due to the massive increase in algal biomass.

Sediment load

The dominant land cover in the catchment is rough pasture and though there is moderate grazing pressure and slight poaching from cattle, the disturbance appears to be relatively low. No evidence of increased sediment loads to the lough was noted from the catchment. High algal biomass is however likely to increase internal sediment loading and this will be predominately organic rather than carbonate deposition. In marl lakes, the increase of organic deposition influences the capacity of the sediments to sequestrate phosphorus and may increase internal nutrient loadings.

Indicators of local distinctiveness

The lough is well known as an important stonewort site. Both *Chara rudis* which is listed as “near threatened” (Stewart, 2004) and the nationally scarce *Chara aculeolata* are present. Despite the deterioration in water quality and clarity, the site still supports six species of stonewort, including the rarities, but these are in very poor condition and the lough no longer has the dense *Chara* spp. beds that it once supported. Otter spraints were noted around the shoreline in 2006, and comprised almost entirely of crayfish remains. None were observed in 2014 and no evidence of crayfish was seen.

Summary

Kilroosky Lough was classified as being in a favourable condition after the 2006 CSM survey. Total P concentrations were moderate and Chl a was low. The clear waters supported extensive beds of charophytes which exceeded 50% of photic zone. Since then, the site has undergone a severe decline in terms of both macrophyte community structure and water quality. In 2014, six species of *Chara* were recorded, but these were at very low frequency and the extensive stonewort beds seen in 2006 were not present. Annual mean TP has by a factor of 4 and Chlorophyll a by a factor of 10 with winter blooms of planktonic algae recorded in 2014 and 2013 (Rolston & McCarthy 2014). This downturn in condition places the site in **unfavourable condition.**

The cause of this dramatic decline is unclear. There does not appear to be any major changes to the catchment land use. Data on any specific changes to the land use and land management is not available, but would beneficial to informing the condition assessment. Direct access by livestock should be kept to a minimum and low intensity agriculture around the shore would be beneficial. Slurry and manure spreading, as well as fertilizer use should be monitored to ensure best practice is adhered to within the ASSI and SAC region. The site is used for shore angling and there are a number of new (replacement) fishing platforms on the south shore with a significant litter problem concentrated around the platforms and swims. There is a recent domestic development within 100 m of the south shore, but no evidence that this has had any direct influence on the lough.

It is recommended that further investigations are undertaken of the surface water and ground water catchments of Kilroosky to determine the primary source of the water supply and identify any major nutrients inputs within the catchment. A full assessment of land use practice and management, including domestic sewerage systems (mains and private) would also help identify any potential nutrient sources.

Table 244 Kilroosky Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Kilroosky Lough NI Lake 1005	**Unfavourable (declining)**	Loss of macrophyte structure. Major downturn in water quality and clarity since 2006. Significant decline in *Chara* spp. cover. Cyanobacterial blooms present. Poor oxygen levels.	Despite a major decline in the condition of the site, Kilroosky still supports 6 species of stonewort and has excellent marginal vegetation. The priority at the site is to identify the primary sources of nutrients and prevent further enrichment. This was one of the best examples of a marl lough in NI and the decline of this priority habitat is a major concern.

Species list

Table 245 List of all plant species recorded at Kilroosky Lough

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	F
Angelica sylvestris	R
Apium nodiflorum	R
Caltha palustris	R
Carex demissa	R
Carex disticha	F
Carex elata	R
Carex nigra	R
Carex rostrata	O
Cicuta virosa	R
Cladium mariscus	F
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum fluviatile	R
Filipendula ulmaria	R
Galium palustre	O
Hydrocotyle vulgaris	R
Hypericum tetrapterum	R
Juncus acutiflorus	R
Juncus effusus	R
Lychnis flos-cuculi	R
Mentha aquatica	O
Menyanthes trifoliata	O
Myosotis laxa	R
Parnassia palustris	R
Phragmites australis	F
Potentilla palustris	R
Ranunculus flammula	R
Rhinanthus minor	R
Salix sp.	O
Schoenoplectus lacustris	F
Sparganium erectum	R
Triglochin palustre	R
Veronica scutellata	R

Submerged & floating species	% Frequency (n = 68)
Chara aculeolata	1
Chara contraria	8
Chara globularis	1
Chara hispida	13
Chara rudis	10
Chara virgata	5
Elodea canadensis	2
Lemna minor	26
Lemna trisulca	10
Menyanthes trifoliata	6
Nuphar lutea	1
Nymphaea alba	3
Potamogeton natans	25
Utricularia vulgaris agg.	26

Survey data

Site Condition Assessment: Kilroosky Lough (30/06/2014)

Lake Details		**Survey Details**		
Lake Name	Kilroosky Lough	Survey Date	30/06/2014	
SSSI Name		Surveyors	BG & SG	
SAC Name		Shore Surveys	2	out of
Grid Ref	H494274	Wader Surveys	2	2
WBID / NI No.	50315 / 1005	Boat Surveys	2	sections

Site Notes:
Water turbid. Chara present, but rarely deeper than 1.5-2 m. Degraded Chara at > 2m. Site looking very poor. New fishing platforms on RoI site, but litter bad at access points

Survey Notes:
Water turbid. Chara present, but rarely deeper than 1.5-2 m. Degraded. Chara at > 2m. Site looking very poor.

New fishing platforms on RoI side, but litter bad at access points

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	310 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes: Very poor Chara growth	
Section	**2**	Maximum depth of colonisation (cm)	280 cm
		Compass bearing of boat transect (°)	50 °
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes: Chara to 2.8 m max	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H4953027434	H4948327507	H4951227475	H4951627404
Section	**2**	H4936727414	H4933927491	H4935427449	H4932327450

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	2472	2473	2474
Section	**2**	2483	2484	2485

3.48. Lough Garrow (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	31 July 2014
NI Lake Number:	1032
WBID:	50252
County:	Fermanagh
Grid reference:	H436190
OS Grid reference (X,Y):	243567,319027
Shoreline development index:	1.212
Surface area (ha.):	5.1
Maximum recorded depth (m):	6.0

Table 246 Condition Assessment Summary Table for Lough Garrow

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species, should be present (excluding *C. vulgaris*)	✓	1 present: *Chara rudis*
	≥ 60% vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	2% of vegetated sample spots comply (2.6% wader, 0% boat)
	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 44.6% of sample sites.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 44.6% of sample sites. Zebra mussels present throughout lough.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	Moderate filamentous algae recorded: 34% wader, 18.9% boat but only 8.8% of points score a '3'
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Emergent zone dominated by *Schoenoplectus lacustris* (25-220 cm), *Phragmites australis* and *Equisetum fluviatile* (25->75 cm). *Nuphar lutea* common in open waters (25-290 cm), intermingled by occasional *Lemna minor* and *Lemna trisulca. Nymphaea alba* only in S1 at 250-260 cm depths. *Potamogeton alpinus* very occasional in S2 (25- >75 cm). *Elodea canadensis* abundant (S2, 25-240 cm). Submerged *Chara rudis* found near margins (25 cm) S2 only, at only 1.5% frequency in the photic zone.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 6 m, Z_{s} = 2.37 m, Z_{v} = 2.9 m
	At least the present structure should be maintained	**X**	Charophytes recorded at an abundance of '3' (1-5 scale) in 1989. Recorded as rare in 2014.
Water quality	Stable nutrients levels: TP target / limit = 10 μgl^{-1}	**X**	TP = 38.7 μgl^{-1} (range 16 – 61 μgl^{-1}) & TN = 0.9 mgl^{-1} (April '14 – Feb '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.1 (range = 7.9 – 8.2)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X**	Waters were well oxygenated and mixed to 4.5 m (6.8 mgl^{-1}), below which levels dropped off to < 0.1 mgl^{-1} at 5.0 m depth. Mean value of DO = 5.7 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial or surface algal blooms.
Hydrology	Natural hydrological regime	✓	Appears natural.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓?	Natural shoreline maintained. Small fishing jetties installed on north-eastern shore. Eroded banks from regular shore angling on southern shore.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	✓	The regionally rare *Chara rudis* present.
	Minimal negative impacts	**X**	Regular shore angling and some boat angling present. Small fishing jetties installed with some litter in close vicinity. Fishing cottage development nearby. Zebra mussels observed in S1 & S2.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 5.1 ha, with no loss of extent of open water.

Macrophyte community composition

Garrow Lough has a limited aquatic macrophyte assemblage with just one *Chara* species present, the regionally rare *Chara rudis* (DOENI, 1995). The 1989 survey recorded charophytes as frequent ('3' on a 1-5 scale) but did not specify which species were present, except for *Chara hispida* var. *major* which was not observed in 2014. By comparison the 2014 survey recorded *C. rudis* at a frequency of 1.5%, an abundance level of '1' (rare). *Hippuris vulgaris, Sparganium emersum* and *Utricularia vulgaris* were all recorded in 1989 at low abundances, but were not observed in 2014, while *P. alpinus, Hydrocharis morsus-ranae, Menyanthes trifoliata* and *Ranunculus lingua* were only observed in 2014. All other species were recorded in both surveys. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 7.6 and 6.76 respectively (See Table 247), which are similar to the 1989 TRS and PLEX scores.

Negative indicator species

Elodea canadensis was recorded as frequent in 1989 ('3' on a scale of 1-5) and was found at 44.6% frequency and moderate abundance (median value of "3" on a 1-5 scale) in the present survey. Though the survey data from 1989 and 2014 are recorded differently, making direct comparison unreliable, the cover of *E. canadensis* appears to have remained stable over the past 26 years. Filamentous algae was also recorded at moderate frequency, with 34% coverage on the wader surveys and 18.9% coverage on the boat surveys, yet only 8.8% of points scored a '3' for coverage. Zebra mussels were observed throughout the lough in high abundance, populating the submerged stems of reeds and hard substrate.

Table 247 Aquatic macrophyte community composition for Garrow Lough, including trophic scores.

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=65)***
Chara rudis	**-**	**-**	**-**	**8.5**	**7.69**	**2**
***Chara* spp.**	**8.5**	**7.69**	**3**	**-**	**-**	**-**
Elodea canadensis	**8.5**	7.95	3	8.5	7.95	45
Fontinalis antipyretica	6.3	5.38	3	6.3	5.38	2
Hippuris vulgaris	7.7	7.88	2	-	-	-
Hydrocharis morsus-ranae	-	-	-	-	-	3
Lemna minor	-	-	-	9.0	8.85	12
Lemna trisulca	10.0	8.85	3	10.0	8.85	9
Nuphar lutea	8.5	6.92	5	8.5	6.92	86
Nymphaea alba	6.7	3.08	1	6.7	3.08	3
Potamogeton alpinus	-	-	-	5.5	5.38	5
Sparganium emersum	10.0	7.5	2	-	-	-
Utricularia vulgaris	5.5	4.23	1	-	-	-
Average score	**8.0**	**6.61**		**7.6**	**6.76**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Pasture and small pockets of broadleaved woodland surround the lough to all sides. The site is bordered by reed beds that are dominated by *Schoenoplectus lacustris, Phragmites australis* and *Equisetum fluviatile,* to maximum depths of 2.2 m. Beyond the emergent zone, *Nuphar lutea* extends out into the deeper open waters, at depths between 0.25 – 2.9 m, intermingled occasionally by *Lemna minor* and *Lemna trisulca. Nymphaea alba* was also recorded, only on the western side of the lough at 2.5 – 2.6 m depths. A limited selection of submerged aquatic flora was recorded: only *Potamogeton alpinus* was observed occasionally on the eastern side at shallow depths of 0.25 - >0.75 m. *Elodea canadensis* is abundant throughout the entire lough, being particularly frequent on the eastern side. Only one charophyte was recorded in the lough, *Chara rudis,* at a low frequency of 1.5% within the photic zone. Charophytes were recorded as frequent ('3' on a 1-5 scale) in 1989. The dense beds often associated with this site type were not present.

Water quality

The water chemistry of Lough Garrow is typical of hard oligo-mesotrophic lakes and ponds, having clear, base-rich water with a moderate nutrient level. Total phosphorus is above the level set out in the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015) however, which may have influenced the moderate levels of filamentous algae recorded on the survey. Chl *a* levels remain fairly low. The Lough is therefore considered to be in an 'unfavourable' condition with respect to trophic

status. The water chemistry data is variable when compared to the values derived from a spot water sample taken in 1989, though no firm conclusions can be drawn from these two sets of independent data as seasonal variation was not taken into account in the 1989 survey. Total phosphorus appears to have decreased over time, while alkalinity has increased. The upper 4.5 m of the water column were well oxygenated, (> 6.8 mgl^{-1}), declining to < 0.1 mgl^{-1} at 5.0 m depth (Figure 54) giving a mean value of only 5.7 mgl^{-1} which is below the GES standards referenced by CSM (JNCC 2015).

Table 248 Water chemistry data for Lough Garrow

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1989
TP	16.2	33.9	60.8	44.0	**38.7**	20
SRP	2.7	11.5	27.9	24.5	**16.7**	1
TN	0.54	0.59	0.96	1.33	**0.86**	0.65
TON	0.045	0.010	0.150	0.635	**0.210**	-
Nitrite	0.003	0.001	0.008	0.007	**0.005**	-
Chl *a*	3.96	10.37	35.42	6.60	**14.09**	7.35
DOC	6.51	6.78	6.68	7.24	**6.80**	-
pH	8.17	8.15	7.91	8.13	**8.08**	7.97
Alk	187	194	181	185	**187**	126
Cond	400	381	372	388	**385**	453
Ca^{2+}	74.7	70.9	68.5	71.3	**71.4**	81.4
Mg^{2+}	5.06	5.25	5.21	4.78	**5.08**	5
Na^{+}	8.74	8.91	8.85	9.02	**8.88**	4.15
K^{+}	3.02	3.00	3.48	3.16	**3.17**	1.05
Cl^{-}	17.10	16.50	16.70	17.00	**16.83**	15.4
SO_4^{2-}	13.70	11.50	12.70	15.00	**13.23**	9.8

Hydrology

Lough Garrow is a small lake fed by one stream that flows in from the north. The lough drains out to the south, where the stream feeds another, smaller lake to the southwest a short distance away. Lough Garrow is hydrologically connected to Upper Lough Erne. The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty with marginal substrates comprising of more organic material and dense root mats among the reed beds.

Sediment load

Disturbance to the site appears to be fairly low. Slight erosion to the margins is visible, as caused by regular shore angling. There was no evidence of increased sediment loads to the lough.

Indicators of local distinctiveness

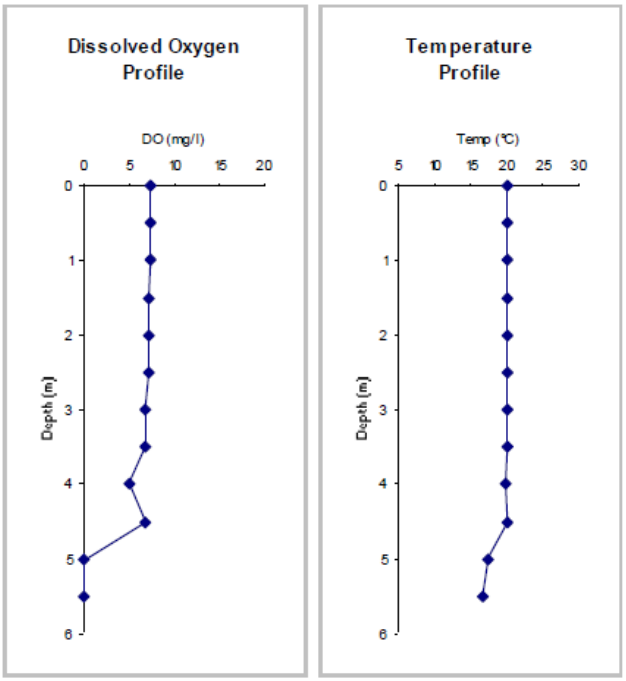
The near-threatened *Chara rudis* (NBN Gateway, 2013) was present at the site.

Figure 54 Dissolved oxygen and temperature profile for Lough Garrow (31/07/2014)

Dissolved Oxygen Profile

GPS Location	H4356619101
Maximum Depth (m)	6 m
Secchi Depth (cm)	2.37 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	7.45	20.1
0.5	7.32	20.1
1	7.3	20.1
1.5	7.15	20.1
2	7.1	20
2.5	7.1	20
3	6.8	20
3.5	6.78	20
4	5.06	19.8
4.5	6.78	20
5	0.06	17.4
5.5	0.08	16.6



Summary

Lough Garrow has one characteristic *Chara* species present, the regionally rare and near-threated *Chara rudis*, but the extent of the charophyte beds is limited to 1.5% of the photic zone. The water chemistry is typical of hard oligo-mesotrophic lakes and ponds, having clear, base-rich water, but TP concentrations were above the CSM guidelines for this lake type (10 μgl^{-1} JNCC 2015). The high TP levels give rise for concern and the low frequency of *Chara* spp. at the site and presence (albeit stable) of *Elodea canadensis* do not meet the expected criteria for the lake type. While it is promising that there appears to have been little change in either the flora or the water quality since 1989, the status of Lough Garrow is considered to be **unfavourable** under the CSM guidelines.

There was slight erosion to the margins from regular shore and boat angling and moderate levels of filamentous algae were recorded, but no evidence of increased sediment or direct nutrient inputs to the lough were observed. A cluster of fishing cottages has developed within close proximity to the lough; further investigation is recommended to ensure that nutrient enrichment is not attributed to the small development. It is considered that palaeoecological investigation would be worthwhile in order to assess baseline targets for both nutrients and macrophytes. The presence of Zebra mussels is also of concern and denotes unfavourable status.

Table 249 Lough Garrow: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Garrow NI Lake 1032	**Unfavourable**	Exceeds upper TP limit and has only low *Chara* spp. cover. Zebra mussels present.	Site appears to be relatively stable and would benefit from reduced nutrient inputs.

Species list

Table 250 List of all plant species recorded at Lough Garrow

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Alnus glutinosa	R
Angelica sylvestris	R
Apium nodiflorum	O
Berula erecta	R
Caltha palustris	R
Carex diandra	R
Carex nigra	R
Carex remota	R
Carex rostrata	O
Carex vesicaria	R
Cicuta virosa	R
Cladium mariscus	R
Epilobium hirsutum	O
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum fluviatile	O
Equisetum palustre	R
Filipendula ulmaria	O
Galium palustre	R
Hippuris vulgaris	R
Hydrocotyle vulgaris	R
Iris pseudacorus	R
Juncus articulatus	R
Juncus inflexus	R
Lycopus europaeus	R
Lysimachia vulgaris	R
Lythrum salicaria	R
Mentha aquatica	F
Menyanthes trifoliata	F
Mosses unid	R
Myosotis scorpioides	R
Phragmites australis	F
Ranunculus flammula	R
Ranunculus lingua	O
Salix sp.	O
Schoenoplectus lacustris	A
Scutellaria galericulata	R
Sparganium erectum	O
Stachys sylvatica	R
Stellaria media	R

Marginal & Emergent species	Abundance (DAFOR)
Typha latifolia	O
Submerged & floating species	**% Frequency (n = 65)**
Chara rudis	2
Elodea canadensis	45
Fontinalis antipyretica	2
Hydrocharis morsus-ranae	3
Lemna minor	12
Lemna trisulca	9
Nuphar lutea	86
Nymphaea alba	3
Potamogeton alpinus	5

Survey data

Site Condition Assessment: Garrow Lough (31/07/2014)

Lake Details		**Survey Details**		
Lake Name	Garrow Lough	Survey Date	31/07/2014	
SSSI Name		Surveyors	SG, EF	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H436190	Wader Surveys	2	2
WBID / NI No.	50252 / 1032	Boat Surveys	2	sections

Site

Survey
Zebra mussels on section 1

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	290 cm
		Compass bearing of boat transect (°)	110 °
		Lateral distance from waters edge to 75cm depth (m)	1 m
		Notes: Section under large Salix Zebras found on boat sur	
Section	**2**	Maximum depth of colonisation (cm)	290 cm
		Compass bearing of boat transect (°)	110 °
		Lateral distance from waters edge to 75cm depth (m)	1 m
		Notes: Zebra mussels everywhere	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H4367219115	H4363819019	H4365219061	H4364619073
Section	**2**	H4367219115	H4363819019	H4365219061	H4364619073

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	128-0351	128-0358	128-0367
Section	**2**	128-0351	128-0358	128-0367

3.49. Tullybrick Lough (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	18 June 2015
NI Lake Number:	1135
WBID:	50433
County:	Armagh
Grid reference:	H750398
OS Grid reference (X,Y):	275028,339818
Shoreline development index:	1.078
Surface area (ha.):	2.0
Maximum recorded depth (m):	11.5

Table 251 Condition Assessment Summary Table for Tullybrick Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	2 present: *Chara hispida* and *Chara rudis*.
	≥ 6/10 sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	27% of vegetated sample spots comply (8% wader, 50% boat). A decline since 2006

Attribute	Target	Status	Comment
Negative indicator species	Negative indicator species absent or at low frequency	✓	*Elodea canadensis* present , but at only 8% frequency, 27% in 2006). No other negative indicator species present.
	Non-native species absent or present at low frequency	✓**?**	*Elodea canadensis* present , but at only 8% frequency, 27% in 2006)
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Mean cover score < 1; median = 0. Total site cover < 20%.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone.	**X**	Varied but species rich emergent zones (*P. australis, S. lacustris, S. erectum* and *Cladium mariscus*). Margins shelve steeply to > 2m from 0.50 – 0.75 m. Submerged beds of *Chara* spp. in S2 beyond reeds, extending to 3.1 m. *Chara* beds present, but not covering 50% of photic zone. No Chara in S1
	Maximum depth distribution should be maintained	**X**	Z_{max} = 11.5 m, Z_{s} = 1.7 m, Z_{v} = 3.1 m.
	At least the present structure should be maintained	**X**	Max depth of colonisation declined from 3.5m in 2006 to 3.1 m in 2015 .
Water quality	Stable nutrients levels: TP target / limit = 10 μgl^{-1}	**X?**	Based on 3 samples Nov 14 – Apr 15. TP = 41.7 μgl^{-1} (range 21.0 – 68.0 μgl^{-1}) & TN = 0.9 mgl^{-1} – summer value required.
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.06 (range = 7.9 – 8.3)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline.	**X**	Waters were well oxygenated to 3.5 m (>8.4 mgl^{-1}), below which levels rapidly dropped off to < 0.5 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	No excessive cyanobacterial blooms or filamentous algal growth observed.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained. Slight disturbance from shore angling
	Natural and characteristic substrate maintained	✓	No evidence of change. Surface sediments exhibit marl deposits.
Sediment load	Natural sediment load maintained	✓	Minor disturbance from cattle poaching, but no evidence of significantly increased sediment loads
	Distinctive elements maintained	✓**?**	*C. rudis* is present, although uncommon in the site.

Attribute	Target	Status	Comment
Indicators of local distinctiveness	Minimal negative impacts	✓?	Slight cattle poaching. Some boat and shore angling. minor litter problems.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 2.0 ha, with no loss of extent of open water.

Macrophyte community composition

There has been little change to the flora of Tullybrick Lough since it was surveyed in 2006 (Table 252). The same two species of *Chara* were recorded: *Chara hispida* and the nationally threatened *Chara rudis*. In addition to the *Chara* spp., the submerged flora had a relatively high frequency of *Lemna trisulca* with *Fontinalis antipyretica, Potamogeton natans* and *Elodea canadensis* less common. *Nuphar lutea* was common around the margins and recorded at 43 % frequency, a slight increase since 2006. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al.* 2006) has increased slightly since 2006, but only as a result of *Lemna minor* being recorded and is unlikely to be indicative of any trophic change at the site. The scores remain similar to the values calculated for 1988 data of 8.1 and 6.96 respectively. The occurrence of *Sparganium natans* was recorded as rare ("1" on a 1-5 scale) in 1988 and was not observed in 2006 or 2015. *Fontinalis antipyretica* was present in 2006 and 2015, but not recorded in 1988. *Elodea canadensis* has been present in the site since 1988, but remains below the frequency considered as unfavourable.

Table 252 Aquatic macrophyte community composition for Tullybrick Lough, including trophic scores.

	2006			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=52)***	**TRS**	**PLEX**	**% occurrence (n=60)***
Chara hispida	**8.5**	**7.69**	**29**	**8.5**	**7.69**	**20**
Chara rudis	**8.5**	**7.69**	**6**	**8.5**	**7.69**	**3**
Elodea canadensis	8.5	7.95	27	8.5	7.95	8
Fontinalis antipyretica	6.3	5.38	8	6.3	5.38	5
Lemna minor	-	-	-	9.0	8.85	17
Lemna trisulca	10.0	8.85	27	10.0	8.85	62
Nuphar lutea	8.5	6.92	29	8.5	6.92	43
Potamogeton natans	6.7	4.23	12	6.7	4.23	10
Average score	**8.1**	**6.96**		**8.3**	**7.2**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was present at only 8% of the vegetated sample points which represents a decrease since 2006 (27%). This species has been present at the site since at least 1988 when it was recorded as frequent ('3' on a scale of 1-5) and does not therefore appear to have reached nuisance levels at the site. No other negative indicators were found.

Macrophyte community structure

Tullybrick Lough has a relatively well developed hydrosere around much of its margin with areas of wet woodland (*Salix* spp. and *Alnus glutinosa*) and extensive emergent reed beds dominated by *Schoenoplectus lacustris* with *Phragmites australis, Carex rostrata, Sparganium erectum, Typha latifolia* and *Cladium mariscus* all common. *Equisetum fluviatile* and *Menyanthes trifoliate* are also present within the emergent zone. Section 1, on the northwest side of the lough comprised of *S. lacustris* dominated reed bed to approximately 1.3 m, beyond which it shelved rather steeply to 3.5 m with only *Nuphar lutea* recorded to a maximum depth of 2.4 m; there were no charophytes recorded within this section. Section 2, on the southeast shore, had a mixed emergent flora, dominated by *Equisetum fluviatile* to 1.1 m. The more gently sloping lake bed was dominated by *Chara* beds to a maximum depth of 3.1 m, the beds being somewhat sparser at depth greater than 2.0 m. *Chara hispida* was the dominant species and although *Chara rudis* was present, it was not confirmed from samples in deeper water.

Although locally dominant, the expanse of *Chara* did not exceed 50% of the photic zone. A sparse fringe *Nuphar lutea* grew up to 3.0 m depth, whilst *Potamogeton natans* grew up to 3.6 m depth from the eastern shore. The NILS survey in 1988 recorded charophytes as abundant ("4" on a 1-5 scale) but did not specify which species were present other than *C. hispida.*

Water quality

The water chemistry of Tullybrick Lough is typical of hard oligo-mesotrophic lakes and ponds, having relatively clear base-rich water (Table 253). The quarterly water quality data lacks a summer value, but mean total phosphorus concentrations suggest the site to exceed the favourable level set out in the CSM guidelines for this lake type (recently lowered from 20 to 10 μgl^{-1} JNCC 2015). The data are insufficient to determine any trends in the trophic status, but spring values are lower than those recorded in 2006 (97 μgl^{-1}) which is indicative of slight improvement. The Lough is therefore considered to be in an 'unfavourable' condition with respect to trophic status. Chl *a* concentrations were relatively low during the sampling period, but in summer the water was slightly turbid and green and the Secchi depth only 170 cm (compared to 330 cm in August 2006). There are no water chemistry data for the summer period however.

Total nitrogen was below the 1.5 mgl-1 set out in the CSM guidance (JNCC 2015) and total oxidised nitrogen relatively low. The lake was stratified in June with the upper 3.5 m of the water column being well oxygenated (> 8.4 mgl-1), but below the thermocline the mean DO was <0.5 mgl-1 and therefore unfavourable for this site type (Figure 55).

Table 253 Water chemistry data for Tullybrick Lough

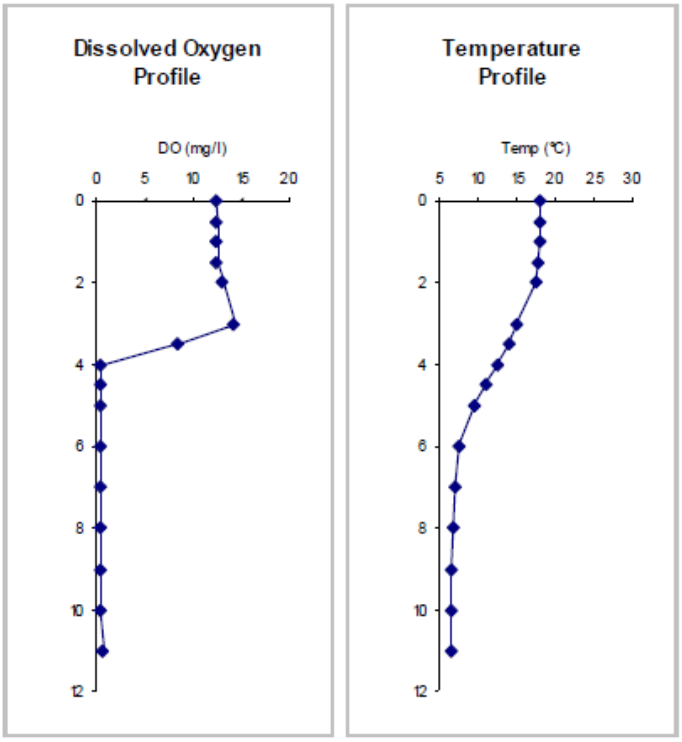
	Nov '14	Feb '15	Apr '15	Mean	2006	1988
TP	20.7	68.3	36.0	**41.7**	51.0	36.0
SRP	6.0	49.4	3.1	**19.5**		
TN	0.57	1.45	0.67	**0.90**	0.8	0.3
TON	0.006	0.481	<0.005	**Low**	-	-
Nitrite	<0.001	0.013	<0.001	**Low**	-	-
Chl *a*	6.16	1.32	8.25	**5.24**	9.9	5.0
DOC	5.1	4.6	4.8	**4.84**	-	-
pH	7.95	8.03	8.27	**8.06**	7.9	8.4
Alk	222	255	223	**233**	156	100
Cond	424	474	405	**434**	435	381
Ca^{2+}	78.4	91.2	76.8	**82.1**	67.3	28.0
Mg^{2+}	7.46	7.54	7.36	**7.45**	7.0	22.6
Na^{+}	8.37	8.57	8.62	**8.52**	7.3	27.0
K^{+}	3.95	4.21	3.84	**4.00**	2.5	0.6
Cl^{-}	15.9	16.6	16.7	**16.4**	9.9	18.3
SO_4^{2-}	7.54	10.8	10.3	**9.55**	11.1	19.1

Figure 55 Dissolved oxygen and temperature profile for Tullybrick Lough (18/06/2015)

Dissolved Oxygen Profile

GPS Location	H7505639831
Maximum Depth (m)	11.5 m
Secchi Depth (cm)	170 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	12.33	18
0.5	12.32	18
1	12.39	17.9
1.5	12.35	17.8
2	13.07	17.5
3	14.25	15.1
3.5	8.4	14
4	0.33	12.4
4.5	0.31	11
5	0.33	9.5
6	0.35	7.6
7	0.37	7
8	0.39	6.7
9	0.4	6.6
10	0.46	6.6
11	0.57	6.6



Hydrology
The lough was once linked to the now disused canal, possibly functioning as a header reservoir. Any water management at the site has long been abandoned and the current hydrological regime at the site appears to be natural with good connectivity to the water table and adjacent wetlands.

Lake substrate
The lake basin is predominantly silty with marginal substrates comprising of organic sediments and root mats within the reed beds. Marl deposits were noted on both plants and on the sediment surface, but these were relatively light.

Sediment load
There is slight poaching from cattle but the disturbance appeared to be low and no evidence of increased sediment loads was noted from the catchment.

Indicators of local distinctiveness
Chara rudis, which is listed as “near threatened” (Stewart, 2004) is present within the site.

Summary
Tullybrick Lough remains relatively unchanged since the survey conducted in 2006, with two species of charophyte present and elevated concentrations of TP. Although supporting the nationally rare *Chara rudis,* this species was recorded at low frequency, and the site and although *Chara hispida* was locally abundant within open water areas, the total extent of charophytes was well below 50% cover within the photic zone and therefore outside the target level set by the CSM (JNCC 2005, 2015). The aquatic flora was otherwise relatively poor with only *Nuphar lutea* and *Lemna trisulca* occurring at greater than 25 % frequency. Although present in the site since before 1988, *Elodea canadensis* does not appear to have increased within the site with current levels lower than in 2006

Water clarity was slightly compromised due to algae in June 2015, but generally chlorophyll *a* concentrations were low within the site and the water clear. Total phosphorus concentrations were slightly lower than in 2006, but exceeded both the 2005 JNCC target and the more stringent 2015 target for hard water sites. The site lies within a region of improved agriculture (mainly cattle grazing), and is therefore likely to receive diffuse nutrient inputs from the catchment. Other water quality parameters are typical for hard water loughs.

Despite maintaining elements of the characteristic flora, Tullybrick Lough falls below the expected criteria for this site type within the CSM (JNCC 2005, 2015). High TP and low overall charophyte cover result in the site being classified as being in **unfavourable condition**. Although classified as unfavourable in terms of the submerged aquatic flora, the site has extensive areas of marginal and emergent vegetation which are typical of this site type. Furthermore, with respect to both water quality and the submerged flora there does not appear to have been any significant deterioration in the condition of the lough since 1988. Site management should focus on identifying and reducing nutrient inputs to the site.

Table 254 Tullybrick Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Tullybrick Lough NI Lake 1135	**Unfavourable**	Poor water quality (TP) Low charophyte cover	Site remains unchanged with high TP levels and relatively low extent of *Chara* spp. cover. The presence of *Chara rudis* makes this site important for its flora and regular monitoring of water quality and the extent of *Chara* beds is recommended.

Species list

Table 255 List of all plant species recorded at Tullybrick Lough

Marginal & Emergent species	Abundance (DAFOR)
Alnus glutinosa	F
Angelica sylvestris	R
Caltha palustris	R
Cardamine flexuosa	R
Cardamine pratensis	R
Carex elata	R
Carex paniculata	R
Carex remota	R
Carex rostrata	R
Cladium mariscus	O
Deschampsia cespitosa	R
Epilobium palustre	R
Equisetum fluviatile	F
Filipendula ulmaria	O
Galium palustre	R
Iris pseudacorus	R
Juncus articulatus	R
Mentha aquatica	R
Menyanthes trifoliata	F
Mosses unid	O
Phragmites australis	O
Potentilla palustris	R
Salix sp.	F
Schoenoplectus lacustris	A
Sparganium erectum	O
Typha latifolia	O
Submerged & floating species	**% Frequency (n = 60)**
Chara hispida	20
Chara rudis	3
Elodea canadensis	8
Fontinalis antipyretica	5
Lemna minor	17
Lemna trisulca	62
Nuphar lutea	23
Potamogeton natans	43

Survey data

Site Condition Assessment: Tullybrick Lough (18/06/2015)

Lake Details		**Survey Details**		
Lake Name	Tullybrick Lough	Survey Date	18/06/2015	
SSSI Name		Surveyors	BG & MST	
SAC Name		Shore Surveys	1	out of
Grid Ref	H750398	Wader Surveys	2	2
WBID / NI No.	50433 / 1135	Boat Surveys	2	sections

Site Notes:

Survey Notes:
Water rather turbid / green

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	240 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes: V steeply shelved	
Section	**2**	Maximum depth of colonisation (cm)	310 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes: Some good Chara beds to c. 240cm	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H7501939901	H7495339878	H7498539875	H7498539878
Section	**2**	H7511139786	H7504639715	H7505139729	H7504839735

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3587	3288	3289
Section	**2**	3294	3295	3303

3.50. Doagh Lough (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	07/08/2014
NI Lake Number:	722
WBID:	50255
County:	Fermanagh
Grid reference:	H078521
OS Grid reference (X,Y):	207809,352080
Shoreline development index:	1.474
Surface area (ha.):	4.0
Maximum recorded depth (m):	3.6

Table 256 Condition Assessment Summary Table for Doagh Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	**X**	2 characteristic species: *Potamogeton obtusifolius* and *Potamogeton lucens*.
	No loss of characteristic species	✓**?**	*P. lucens* present in 1988, 2006 and 2014. *Callitriche hamulata* not recorded but only observed 'off transect' in 2006. Change in CSM guidance (JNCC, 2015) has resulted in a reduction in the number of characteristic species when compared to the 2006 survey (JNCC, 2005).

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	44% of vegetated sample spots comply.
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 23.5% of submerged sample points.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Good marginal habitat with mix or reeds and tall herbs dominated by *P. australis, T. latifolia, C. rostrata, C. mariscus, G. palustre, Potentilla palustris* and *E. fluviatile*. *N. lutea* fringe (0.25 – 1.0 m) interspersed with *N. alba* (0.25 -1.6 m) and *P. lucens* (0.50 – 2.1 m) beds. No plant growth at depths > 2.1 m.
	Maximum depth distribution should be maintained	✓**?**	Z_{max} (recorded) = 4 m, Z_s = 0.43m, Z_v = 2.1m; turbid. Z_v in 2006 was 2.4m so a slight decrease. Within acceptable survey error boundaries and/or annual variation.
	At least the present structure should be maintained	✓	No change evident.
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X?**	TP = 52.0 μgl^{-1} (range = 23.1 – 82.4 μgl^{-1}) & TN = 0.9 mgl^{-1} (Apr'14 – Feb'14)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.46 (range = 7.3– 7.7)
	Adequate dissolved O_2 throughout the water column (mean > 6mgl^{-1} below thermocline)	✓**?**	Waters were well oxygenated to 2.5 m (>5.1 mgl^{-1}), below which levels dropped off to < 0.56 mgl^{-1} at 3.0 m depth. No distinct thermocline present.
	No excessive growth of cyanobacteria or green algae	✓	No blooms present,
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓**?**	No evidence of increased sediment loads, although there is moderate grazing and slight poaching.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓**?**	Broad-leaved *Potamogeton* spp. present. No loss of characteristic species.

Attribute	Target	Status	Comment
	Minimal negative impacts and no fish farming	✓?	Shore and boat angling.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 4.0 ha, with no loss of extent of open water.

Macrophyte community composition

Doagh Lough supports 2 characteristic species, including one broad-leaved *Potamogeton* spp. (*Potamogeton lucens, P. obtusifolius*). In 2006 *C. hamulata* was not observed in the survey sections but was present at the site. A survey carried out in 1988 (NILS) only recorded five aquatic species, including the characteristic species *P. lucens*. In 2005 a WMU survey was performed which recorded *P. gramineus, Chara spp*., *P. pectinatus*, and *P. pusillus* (Waterman, pers. comm.), whilst *C. hamulata, L. minor, Menyanthes trifoliata* and *P. obtusifolius* were only observed in 2006 and 2014. These differences in species composition is perhaps a result of varying sample methodology as both the 2006 and 2014 surveys, which use the same methods, have produced very similar results despite being surveyed by different biologists 8 years apart. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site have been similar for all 3 surveys (1988, 2006 and 2014) (Table 257).

Table 257 Aquatic macrophyte community composition for Doagh Lough, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=49)***	**TRS**	**PLEX**	**% occurrence (n=81)**
Callitriche hamulata	**5.0**	**6.15**	**+**	**-**	**-**	**-**
Elodea canadensis	8.5	7.95	45	8.5	7.95	24
Lemna minor	9.0	8.85	2	9.0	8.85	4
Menyanthes trifoliata	5.3	-	16	5.3	-	12
Nuphar lutea	8.5	6.92	20	8.5	6.92	38
Nymphaea alba	6.7	3.08	39	6.7	3.08	33
Potamogeton lucens	**10.0**	**7.88**	**49**	**10.0**	**7.88**	**38**
Potamogeton obtusifolius	**7.3**	**6.54**	**12**	**7.3**	**6.54**	**2.5**
Sparganium emersum	10.0	7.50	8	10.0	7.50	13.6
Average score	**7.8**	**6.86**		**8.2**	**6.96**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was recorded at an overall frequency of 24%, a decrease since 2006 (45%) and 1988 ('4' on a scale of 1-5). Although abundance levels have

therefore probably dropped over the years, the persistence of this non-native species at the site is unfavourable.

Macrophyte community structure

Doagh Lough is bounded by a mix of tall herbs and dense *Scirpo-Phragmitetum* communities that are mainly comprised of *Phragmites australis*, *Typha latifolia, Cladium mariscus* and *Carex rostrata* with an occasional frequency of *Schoenoplectus lacustris*. Beyond the reed margin lies rough pasture with a small area of wet woodland to the west. The south of the lough is bordered by a large limestone cliff. The marginal and emergent community extends into water depths of approximately 0.50 m, beyond which *Nuphar lutea* fringes the lough (0.25 – 0.75 m) interspersed with *Nymphaea alba* (0.25 – 2.1 m). *P. obtusifolius* was confined to water depths less than 0.75 m with *P. lucens* dominating the areas near the southern lough margin at depths up to 2.1 m. No plants were found beyond this depth. A full species list is given in Table 260 below.

Water quality

Table 258 Water chemistry data for Doagh Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	2006	1988
TP	47.2	82.4	54.6	23.1	**52.0**	0.049	36
SRP	7.2	43.0	20.8	12.5	**21.0**	n/a	25
TN	0.65	1.14	1.28	0.53	**0.9**	0.70	0.78
TON	<0.005	0.061	0.192	0.187	**<0.11**	n/a	n/a
Nitrite	<0.001	0.005	0.004	0.003	**<0.003**	n/a	n/a
Chl a	12.10	2.75	2.86	3.03	**5.19**	6.60	7.1
DOC	6.57	20.5	17.7	4.61	**12.4**	n/a	n/a
pH	7.72	7.32	7.32	7.62	**7.46**	7.60	7.46
Alk	87	78	64	47	**69**	67.60	49
Cond	196	172	158	179	**176**	184	244
Ca2+	30.7	26.1	22.6	20.2	**24.9**	35.00	28
Mg2+	3.21	3.69	2.85	2.81	**3.14**	2.90	4.9
Na+	7.23	8.09	8.19	12.4	**8.98**	7.10	9.3
K+	1.09	1.39	1.89	1.35	**1.43**	3.70	0.3
Cl-	12.7	11.8	15.2	25.8	**16.4**	11.40	19.4
SO42-	<10	4.9	5.22	5.42	**<6.39**	5.30	13.27

Doagh Lough is classified as a naturally eutrophic lake and falls within the 'very shallow' category (Z_{max} = 4 m) under the UK WFD lake typology. The current TP concentration (52 μgl^{-1}) therefore places the site just outside the target level set by the CSM (JNCC 2015). In 1988 a spot water sample taken in July recorded a lower TP concentration of 36 μgl^{-1}, which suggests the site may have suffered enrichment, but the data are insufficient to confirm this. The mean annual chlorophyll *a* concentration is in the acceptable range for the lake type (23 μgl^{-1} has been suggested as the upper limit for Chl *a* in HA VSh lakes (Willby 2006)) and is lower

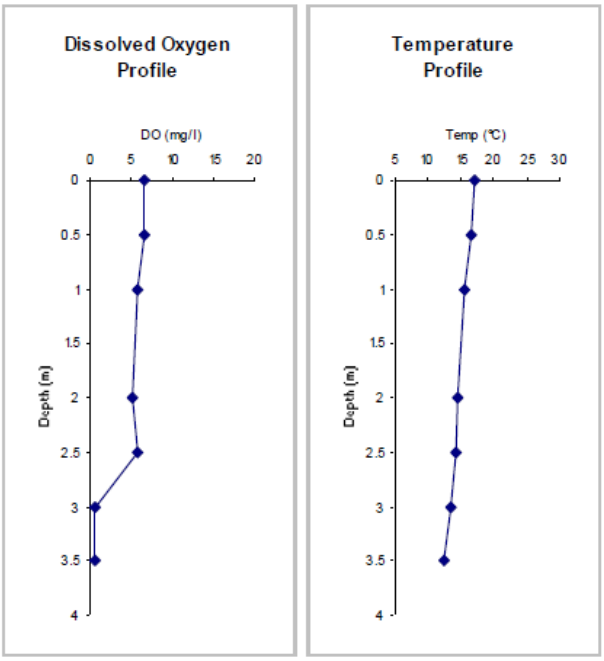
than that recorded from 2006 and from the summer spot sample in 1988. The water column was well oxygenated in the upper 2.5 m (>5.1 mgl^{-1}), declining to < 0.56 mgl^{-1} at 3.0 m depth (Figure 56).

Figure 56 Dissolved oxygen and temperature profile for Doagh Lough (07/08/2014)

Dissolved Oxygen Profile

GPS Location	H0771852169
Maximum Depth (m)	4 m
Secchi Depth (cm)	43 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	6.64	17.1
0.5	6.51	16.6
1	5.78	15.5
2	5.1	14.6
2.5	5.85	14.3
3	0.56	13.5
3.5	0.66	12.6



Hydrology

Doagh Lough receives its water from a stream to the west that flows through some coniferous woodland and is adjacent to a road. It drains via a stream to the north. The hydrological regime at the site appears natural.

Lake substrate

The lake substrate is predominantly silty, which is consistent with the underlying geology and alluvial soils in the catchment.

Sediment load

There is grazing on the land surrounding the lough but poaching of the lake shore is minimised by the dense marginal vegetation. There was no evidence of increased sediment loads to the lough.

Indicators of local distinctiveness

None specified.

Summary

From the current survey, Doagh Lough does not meet the criteria for submerged and floating leaved flora, supporting only two characteristic species, including one broad-leaved *Potamogeton* spp. (*P. lucens*). The mean annual TP concentration was just over the acceptable level for this lake type (JNCC 2015). *Elodea canadensis* was frequent within the survey sections, as it was in 2006 and in 1988 (NILS) and thus there is no firm evidence of any recent deterioration in the aquatic flora at the site.

While the site does not achieve all the criteria required within the CSM for favourable status, it does nonetheless support an interesting aquatic flora (which appears to be stable), including mixed water lily beds and a relatively high density of *P. lucens,* and the site has an extensive and rich marginal/emergent flora. In 2006 knowledge of three other taxa (*P. pusillus, P. gramineus* and *Chara* spp.) recorded from different surveys (Waterman, pers. comm.), elevated the status to favourable. However, these species were again not recorded using CSM survey methods and with no evidence of them having been recorded recently the status is therefore downgraded to **Unfavourable.** This unfavourable classification is further justified by a deterioration in trophic status since 2006 suggesting the site to have become more eutrophic.

There is grazing on the land surrounding the lough but poaching of the lake shore is minimised to an extent by the dense marginal vegetation. The lough could be affected to a slight extent by logging within the catchment and/or road drainage. No evidence of direct nutrient inputs were observed, though less intensive agriculture around the shore would be beneficial. There is possibly boat and shore angling at the site although the jetty is very rotten and unstable. Any attempt to stock the site with coarse fish should be resisted.

The priority for the site is to ascertain and control any sources of nutrients to prevent further eutrophication. A slight drop in TP and reappearance of species recently recorded at the site would place Doagh Lough in favourable status again.

Table 259 Doagh Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Doagh Lough NI Lake 722	**Unfavourable**	TP just exceeds the upper limit for eutrophic sites Only 3 characteristic species recorded at relatively low frequency. High frequency of *E. canadensis*	Reduced from favourable status in 2006 due to lack of evidence of additional characteristic species. Current mean annual TP concentrations have increased and management should focus on reducing inputs. Permit no fish stocking.

Species list

Table 260 List of all plant species recorded at Doagh Lough

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	F
Equisetum fluviatile	F
Typha latifolia	F
Schoenoplectus lacustris	O
Carex rostrata	O
Alnus glutinosa	R
Menyanthes trifoliata	R
Juncus acutiflorus	R
Myosotis scorpioides	R
Mentha aquatica	R
Potentilla palustris	R
Galium palustre	R
Juncus effusus	R
Salix sp.	R
Senecio aquaticus	R
Caltha palustris	R
Ranunculus flammula	R
Hydrocotyle vulgaris	R
Filipendula ulmaria	R
Rorippa nasturtium-aquaticum	R
Angelica sylvestris	R
Succisa pratensis	R
Cladium mariscus	R
Alisma plantago-aquatica	R
Submerged & floating species	**% Frequency (n = 81)**
Elodea canadensis	24
Lemna minor	4
Menyanthes trifoliata	12
Nuphar lutea	38
Nymphaea alba	33
Potamogeton lucens	38
Potamogeton obtusifolius	3
Sparganium emersum	14

Survey data

Site Condition Assessment: Doagh Lough (07/08/2014)

Lake Details		**Survey Details**		
Lake Name	Doagh Lough	Survey Date	07/08/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H078521	Wader Surveys	3	3
WBID / NI No.	50255 / 722	Boat Surveys	3	sections

Site Notes:

Survey Notes:
Lough separated into 2 basins. 2006 survey completed only in the larger basin close to the road. This survey performed an additional transect in the smaller basin.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	110 cm
		Compass bearing of boat transect (°)	214 °
		Lateral distance from waters edge to 75cm depth (m)	4 m
		Notes: Very steep drop off above 75cm	
Section	**2**	Maximum depth of colonisation (cm)	210 cm
		Compass bearing of boat transect (°)	352 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Midpoint (50m) changed as previous one wrong.	
Section	**3**	Maximum depth of colonisation (cm)	150 cm
		Compass bearing of boat transect (°)	198 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H0771152125	H0776552148	H0775252102	H0775052114
Section	**2**	H0769652238	H0764952183	H0764952232	H0662052221
Section	**3**	H0788451980	H0778151995	H0782451988	H0783252001

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0193	0194	0196/0197
Section	**2**	0197	0199	0200
Section	**3**	0202	0203	0204

3.51. Kinarla Lough (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation.

Survey Date	04 July 2014
NI Lake Number:	742
WBID:	50354
County:	Fermanagh
Grid reference:	H215453
OS Grid reference (X,Y):	221547,345267
Shoreline development index:	1.267
Surface area (ha.):	3.3
Maximum recorded depth (m):	2.7

Table 261 Condition Assessment Summary Table for Kinarla Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	**X**	3 characteristic species present in 2014: *Callitriche sp, P. praelongus & Utricularia vulgaris agg.*
	No loss of characteristic species	✓**?**	*P. obtusifolius* recorded in 1988 NILS survey. Methods not directly comparable.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X**	22% of vegetated sample spots comply
Negative indicator species	Negative indicator species absent or at a low frequency	✓	*Elodea canadensis* only recorded in the marginal survey
	Non-native species absent or present at low frequency	**X?**	*Elodea canadensis* only recorded in the marginal survey
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Small amount of filamentous algae recorded. <1%. No 3's.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Lake surrounded by mixed woodland, residential properties, an industrial site, arable land and formal gardens. Margins comprised of areas of reed fringe consisting of *P. australis* , *S. lacustris, T. latifolia and C. rostrata.* Beyond the reed fringe an *N. lutea* fringe up to 2.5m depth. In section 1 a zone of *P. praelongus* beyond the *N. lutea* fringe, in sections 2 & 3 *P. praelongus* grows amongst the *N. lutea* up to 2.5m depth.
	Maximum depth distribution should be maintained	**-**	Z_{max} (recorded) = 2.7 m; Z_s = 0.96 m; Z_v = > 2.5m.
	At least the present structure should be maintained	**-**	No comparable data
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 86 μgl^{-1} (20 – 145 μgl^{-1}) & TN = 0.81 mgl^{-1} (Apr'14 – Feb'15)
	Stable pH / ANC values: pH >7.00 & <9.00	✓	pH = 7.89 (range = 7.7 – 8.6)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	**X**	> 8 mgl^{-1} down to 1.5m depth. Mean DO <5 mgl^{-1} below the thermocline
	No excessive growth of cyanobacteria or green algae	✓	None noted
Hydrology	Natural hydrological regime	✓	Appears natural.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓?	Natural shoreline maintained. Macrophyte cutting on the north eastern shore near large house.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	*P. praelongus* present. *Sium latifolium* present in the margins
	Minimal negative impacts and no fish farming	-	

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 3.3 ha, with no loss of extent of open water.

Macrophyte community composition

Kinarla Lough has a moderate diversity of macrophyte taxa with this survey recording 11 species of submerged and floating leaved taxa, 3 of which are characteristic for a eutrophic lake (JNCC 2015). 2 species of *Potamogeton* were recorded including the characteristic broadleaved *P. praelongus.* Other submerged macrophytes included: *Elodea canadensis, Callitriche sp., Fontinalis antipyretica,* and *Utricularia vulgaris agg*.. A total of 35 macrophyte taxa were recorded in the survey including the notable marginal taxa *Sium latifolium*.

The NI lake survey (NILS) recorded a similar set of aquatic species at Kinarla Lough as the current survey, although some species are no longer present in the lough. Notable differences include the presence of *Potamogeton berchtoldii, Potamogeton obtusifolius, Hippuris vulgaris* and Charophytes in 1988 but absent in the current survey. *Potamogeton pusillus was* recorded in the current survey but not in the NILS survey. Although the NILS and current survey used different methodologies, the absence of the above species suggests that the sites has deteriorated somewhat. Charophytes are sensitive to increasing eutrophication where excessive phytoplankton growth can limit light penetration to deeper waters, areas where charophytes often inhabit. The continued presence of *P. praelongus* does not support this hypothesis as it is often the first species to disappear when a water body shifts towards increasingly eutrophic conditions (Egertson *et al* 2004). The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated form the NILS 1988 data, suggesting that the tropic status is stable.

Negative indicator species

Elodea canadensis was only found at one location in the marginal survey, a significant reduction since the NILS survey recorded it as “abundant”. Its presence at

the site is likely to fluctuate and a persistent population is considered to be unfavourable under CSM guidance (JNCC 2015).

Table 262 Aquatic macrophyte community composition for Kinarla Lough, including trophic scores

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=85)***
Callitriche sp.	**-**	**-**	**2**	**-**	**-**	**+**
Charophytes	**8.5**	**7.69**	**5**	**-**	**-**	**-**
Chara globularis	**8.5**	**7.69**	**+**	**-**	**-**	**-**
Elodea canadensis	8.5	7.95	**4**	8.5	7.95	+
Fontinalis antipyretica	-	-	**-**	6.3	5.38	3.5
Hippuris vulgaris	7.7	7.88	**3**	-	-	-
Lemna minor	9.0	8.85	2	9.0	8.85	15.3
Lemna trisulca	10.0	8.85	4	10.0	8.85	8.2
Nuphar lutea	8.5	6.92	5	8.5	6.92	68.2
Potamogeton berchtoldii	7.3	7.69	1	-	-	-
Potamogeton obtusifolius	**7.3**	**6.54**	2	**-**	**-**	**-**
Potamogeton pusillus	-	-	-	8.5	7.95	1.2
Potamogeton praelongus	**7.3**	**5.38**	4	**7.3**	**5.38**	**18.8**
Sparganium emersum	10.0	7.5	1	10.0	7.5	1.2
Utricularia vulgaris agg.	**5.5**	**4.23**	4	**5.5**	**4.23**	**5.9**
Average score	**8.2**	**7.30**		**8.2**	**7.00**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Macrophyte community structure

Kinarla lough is surrounded by mixed woodland apart from the north eastern shore which is bordered by a manicured lawn. Beyond the woodland there are residential properties, an industrial estate and arable land. The lough is bordered by reeds beds that comprise; *S. lacustris, P. australis*, *T. latifolia*, *C. rostrata* and *S. erectum*. Beyond the reed fringe there is a clear *N. lutea* zone. *P. praelongus* grows amongst the *N. lutea* as well as beyond the lily zone up to 2.5m. *U. vulgaris* agg. is present mainly <0.75cm depth as well as *F. antipyretica*, *L. trisulca* and *L. minor*. *S. latifolium* is present in the margins.

Water quality

Kinarla Lough is a shallow (Z_{max} recorded = 2.7 m), eutrophic lake with an annual mean TP (86 μgl^{-1}) which is above the guideline levels for this type of lake (JNCC 2015) and classifies it as “unfavourable” with respect to trophic status. Small amounts of filamentous algae were recorded and no algal blooms were present. The mean Chlorophyll a levels were also high which represents increased phytoplankton abundance, generally a response to elevated TP levels. Nearby dwellings,

agriculture and/or industrial activity are all potential sources of phosphorous close to Kinarla lough. The upper 1.5 m of the water column was well oxygenated (> 8 mgl^{-1}), dropping to less than 3 mgl^{-1} below 2.0 m (Figure 57). Mean DO below the thermocline was <5 mgl^{-1} and hence fails to meet guideline levels (JNCC 2015).

Table 263 Water chemistry data for Kinarla Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1988
TP	46.3	145.0	133.0	20.6	86.0	36
SRP	4.8	89.4	56.1	13	38.0	25
TN	0.51	0.95	1.22	0.55	0.81	0.78
TON	<0.005	<0.005	0.157	0.122	<0.072	n/a
Nitrite	<0.001	<0.001	0.012	0.006	<0.005	n/a
Chl *a*	15.18	16.50	60.72	28.49	30.2	7.1
DOC	4.44	6.67	5.35	3.38	4.96	n/a
pH	8.02	7.78	7.65	8.57	7.89	7.46
Alk	232	216	210	210	217	49
Cond	521	462	521	624	532	244
Ca^{2+}	92	80.2	95.5	92.9	90.2	28
Mg^{2+}	5.77	6.25	6.38	5.67	6.02	4.9
Na^{+}	20	17.2	16.7	39.9	23.50	9.3
K^{+}	2.56	2.8	3.56	2.45	2.84	0.3
Cl^{-}	31.9	23.4	23.6	74.4	38.3	19.4
SO_4^{2-}	25.7	20.4	47.7	35.1	32.2	13.27

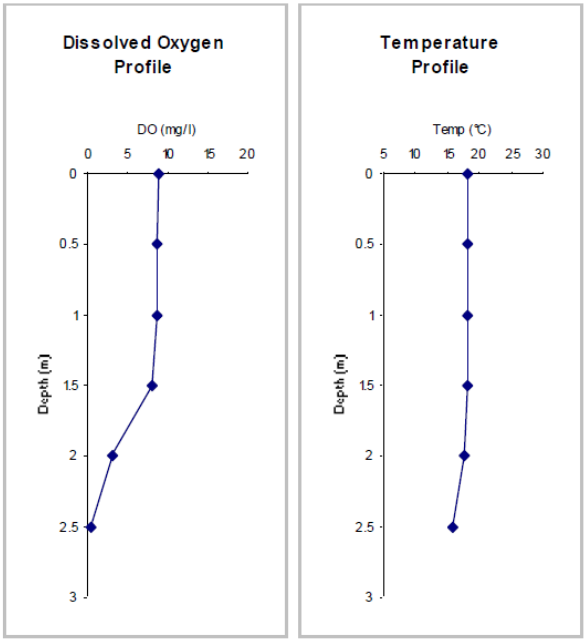
Figure 57 Dissolved oxygen and temperature profile for Kinarla Lough (04/07/2014)

Dissolved Oxygen Profile

GPS Location	H2152745269
Maximum Depth (m)	2.7 m
Secchi Depth (cm)	96 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	8.83	18.2
0.5	8.71	18.2
1	8.61	18.2
1.5	8.08	18.1
2	3	17.6
2.5	0.42	15.7



Hydrology
The hydrological regime at the site appears natural (albeit within the influence of the Lower Lough Erne system).

Lake substrate
The lake basin is predominantly silty.

Sediment load
The dominant land cover in the catchment is mixed woodlands, industry, residential and arable farming. On the north eastern side of the lough managed gardens are present. Disturbance appears to be relatively low immediately around the lough and the sediment load appears natural throughout the lough. However land use in the surrounding catchment consists of activities which may add to the sediment load, such as arable farming. The extent and impact of these activities is unknown.

Indicators of local distinctiveness
Potamogeton praelongus is frequent in the lough. *Sium latifolium* was recorded in the margins, although frequent in Fermanagh, this is a UK priority species.

Summary
Kinarla lough is a moderate example of a eutrophic lake. The aquatic flora of the lough is moderately diverse containing four characteristic submerged and floating leaved macrophytes which is below the required number to meet favourable status under CSM guidelines (JNCC, 2015). *Potamogeton praelongus* was frequent in deeper water (up to 2.5m), a species which is often the first submerged species to disappear as a result of eutrophication (Egertson *et al* 2004). *P. praelongus* was recorded at Kinarla lough in the 1988 NILS survey so its continued presence, along with a number of other taxa, at the site suggests that the macrophyte community is relatively stable. However the absence of charophytes is of concern. TP levels were above the guideline levels set for this lake type (JNCC 2015) and mean chlorophyll a concentrations were high also indicating that the site may be suffering from increased eutrophication. *E. canadensis* has been present at the site at least since the NILS survey and also appears to be stable. Nowhere does it dominate and no detrimental impact on native taxa is apparent.
Given the above evidence Kinarla Lough is classed as **Unfavourable.**

Table 264 Kinarla Lough: Overview

Water Body	Status	Reason(s) for failure	Comments
Kinarla Lough NI Lake 742	**Unfavourable**	High TP and high chlor a. Only 4 characteristic species present at low frequency	Continued presence of *P. praelongus* but absence of charophytes. *S. latifolium* present in the lake margins.

Species list

Table 265 List of all plant species recorded at Kinarla Lough

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	F
Schoenoplectus lacustris	R
Equisetum fluviatile	R
Sparganium erectum	R
Salix sp.	R
Alnus glutinosa	R
Carex sp.	R
Rumex hydrolapathum	R
Sium latifolium	R
Cicuta virosa	R
Filipendula ulmaria	R
Typha latifolia	R
Potentilla palustris	R
Ranunculus lingua	R
Fontinalis antipyretica	R
Menyanthes trifoliata	R
Epilobium hirsutum	R
Galium palustre	R
Epilobium palustre	R
Angelica sylvestris	R
Solanum dulcamara	R
Carex rostrata	R
Iris pseudacorus	R
Alisma plantago-aquatica	R
Mentha sp.	R
Lysimachia vulgaris	R
Submerged & floating species	**% Frequency (n = 85)**
Callitriche sp.	+
Elodea canadensis	+
Fontinalis antipyretica	4
Lemna minor	15
Lemna trisulca	8
Nuphar lutea	68
Potamogeton pusillus	1
Potamogeton praelongus	19
Sparganium emersum	1
Utricularia vulgaris agg.	6

Survey data

Site Condition Assessment: Kinarla Lough (04/07/2014)

Lake Details		**Survey Details**		
Lake Name	Kinarla Lough	Survey Date	04/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H215453	Wader Surveys	3	3
WBID / NI No.	50354 / 742	Boat Surveys	3	sections

Site Notes:

Survey Notes:
Turbid water, difficult to see into the water column.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	250 cm
	Compass bearing of boat transect (°)	337 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes:	
Section 2	Maximum depth of colonisation (cm)	250 cm
	Compass bearing of boat transect (°)	148 °
	Lateral distance from waters edge to 75cm depth (m)	3 m
	Notes: No access to perform thorough marginal survey	
Section 3	Maximum depth of colonisation (cm)	250 cm
	Compass bearing of boat transect (°)	196 °
	Lateral distance from waters edge to 75cm depth (m)	1 m
	Notes:	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H2146145209	H2153545207	H2149545189	H2150545235
Section 2	H2145845264	H2154545314	H2150145292	H2151845281
Section 3	H2156545310	H2163745250	H2160445279	H2159745274

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0176	0178	0177
Section 2	0179	0180	0181
Section 3	0182	0185	0183

3.52. Drumcullion Lough (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	09 July 2014
NI Lake Number:	760
WBID:	50073
County:	Fermanagh
Grid reference:	H275397
OS Grid reference (X,Y):	227537,339727
Shoreline development index:	1.381
Surface area (ha.):	21.2
Maximum recorded depth (m):	2.2

Table 266 Condition Assessment Summary Table for Drumcullion Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species, including 1 broad-leaved *Potamogeton* spp.	**X**	5 characteristic species present in 2014: *Callitriche hermaphroditica, Chara globularis, Ranunculus circinatus, Spirodella polyrhiza* and *P. obtusifolius*.
	No loss of characteristic species	✓**?**	4 characteristic species in 1990, 5 in 2014, but possible loss / decline of *L. uniflora.*

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	42% of vegetated sample spots comply.
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea nuttallii* recorded at 97% of submerged sample points. Zebra mussels observed in S2.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	2% of sampling points scored a cover of '3'
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Excellent marginal habitat. Typical *Scirpo-Phragmitetum* community of *P. australis, S. lacustris, S. erectum* and *C. rostrata.* Frequent marginal emergents: *A. plantago-aquatica, C. palustris, J. articulatus, J. effusus, J. inflexus, A. nodiflorum* and *B. umbellatus. N. lutea* dominates the shallow and open waters (25-170cm), intermingled by *L. minor, L. trisulca* and *S. polyrhiza* (25 - >75 cm). Localised beds of *P. pusillus* in S1, S3 & S4 (25-150 cm), occasional patches of *P. obtusifolius* in S1 & S2 (75-160 cm) and *P. pectinatus* in S2 & S3 (110-150 cm). *R. circinatus* and *R. aquatilis* both common in S1, occasional S2 (50- ~120 cm). Beds of *C. globularis* in S1 & S3 between 75-130 cm, while *F. antipyretica* and *C. hermaphroditica* both rare in S1 & S4. *E. nuttallii* dominant species in all sections, across depths of 25-200 cm. Species zonation evident.
	Maximum depth distribution should be maintained	✓**?**	Z_{max} (recorded) = 2.2 m, Z_s = 1.55m, Z_v = 2.0m.
	At least the present structure should be maintained	✓**?**	Hydrosere present – no change evident, but 1990 data insufficient for comparison.
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 143 μgl^{-1} (range = 105 - 166) & TN = 1.86 mgl^{-1} (April '14 – Feb '15)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 8.1 (range = 7.9 – 8.4)

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	-	Technical problems with DO meter therefore O_2 not recorded.
	No excessive growth of cyanobacteria or green algae	✓	None recorded.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓?	No clear evidence of increased sediment loads - some poaching and grazing observed.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	X	*Eleocharis acicularis* (nationally restricted distribution) and *Littorella uniflora* recorded in 1990 but not in 2014.
	Minimal negative impacts and no fish farming	X	Some poaching of shore. Abundant *E. nuttallii.* Zebra mussels recorded in 2014.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 21.2 ha, with no loss of extent of open water.

Macrophyte community composition

Drumcullion Lough has a species rich submerged and floating leaved aquatic macrophyte flora both overall (15 species) and with respect to the representation of characteristic species. In 2014, 5 characteristic species were recorded: *Callitriche hermaphroditica, Chara globularis, Ranunculus circinatus*, *Spirodella polyrhiza and P. obtusifolius*. This is a slight improvement to 1990, when four characteristic species were recorded. The lough also has a rich marginal and emergent flora; forty-nine different aquatic macrophyte taxa were recorded in 2014. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.5 and 7.79 respectively (Table 267). Comparison with scores calculated from the 1990 survey species data (8.2 and 7.11 respectively) suggests that there has been a slight increase in trophic status. Examination of the 1990 and 2014 species data may support this conclusion; the absence of *Littorella uniflora* from the 2014 survey and the rampant colonisation of *Elodea nuttallii* all suggest enrichment. However, care should be taken in drawing firm conclusions from the comparison of data collected using different sampling methods. Further investigation is recommended.

Negative indicator species

Elodea nuttallii was recorded at an overall frequency of 97%, which is significantly above the upper limit of the range acceptable for favourable condition under the guidelines laid down within the favourable condition tables (JNCC 2015). This species has not been recorded prior to this survey; in 1990 a high abundance of *Elodea canadensis* was recorded, with a “5” (on a 1-5 scale). Zebra mussels were

also recorded in the lough, to the southwest, in deeper waters of 120 – 200 cm depth.

Table 267 Aquatic macrophyte community composition for Drumcullion Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=145)***
Apium inundatum	7.0	7.50	1	-	-	-
Butomus umbellatus	-	-	-	-	-	1
***Callitriche* agg.**	**-**	**-**	**2**	**-**	**-**	**-**
Callitriche hermaphroditica	**-**	**-**	**-**	**8.5**	**7.69**	**3**
Chara globularis	**-**	**-**	**-**	**8.5**	**7.69**	**13**
Eleocharis acicularis	8.5	7.95	3	-	-	-
Elodea canadensis	8.5	7.95	5	-	-	-
Elodea nuttallii	-	-	-	10.0	7.95	97
Fontinalis antipyretica	-	-	-	6.3	5.38	1
Lemna minor	9.0	8.85	4	9.0	8.85	57
Lemna trisulca	10.0	8.85	3	10.0	8.85	54
Littorella uniflora	**6.7**	**4.23**	**2**	**-**	**-**	**-**
Menyanthes trifoliata	-	-	-	5.3	-	1
Nuphar lutea	8.5	6.92	2	8.5	6.92	41
Nymphaea alba	6.7	3.08	2	-	-	-
Persicaria amphibia	9.0	7.95	2	-	-	-
Potamogeton berchtoldii	7.3	7.69	2	-	-	-
Potamogeton crispus	**8.5**	**7.95**	**2**	**-**	**-**	**-**
Potamogeton natans	6.7	4.23	1	-	-	-
Potamogeton obtusifolius	**7.3**	**6.54**	**4**	**7.3**	**6.54**	**4**
Potamogeton pectinatus	10.0	8.85	2	10.0	8.85	10
Potamogeton pusillus	-	-	-	8.5	7.95	12
Potamogeton gramineus x lucens		**7.69**	**3**	**-**	**-**	**-**
Ranunculus aquatilis	-	-	-	8.5	7.95	10
Ranunculus circinatus	**-**	**-**	**-**	**10.0**	**8.85**	**11**
Sparganium emersum	10.0	7.50	1	-	-	-
Spirodela polyrhiza	**-**	**-**	**-**	**-**	**-**	**21**
Average score	**8.2**	**7.11**		**8.5**	**7.79**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Drumcullion Lough's catchment comprises predominantly of rough pasture/improved grassland. The lough has an excellent marginal habitat comprising of a mix of reed and herbs. A typical *Scirpo-Phragmitetum* community dominates the fringe, consisting mainly of *Phragmites australis, Schoenoplectus lacustris, Sparganium erectum* and *Carex rostrata,* at depths between 25 - >75 cm. Other frequently encountered marginal species include *Alisma plantago-aquatica, Caltha palustris, Juncus articulatus, Juncus effusus, Juncus inflexus, Apium nodiflorum* and *Butomus umbellatus.* The lough's submerged and floating leaved vegetation shows some degree of zonation. *Nuphar lutea* dominates the shallow and open waters at depths of 25 – 170 cm, intermingled by *Lemna minor, Lemna trisulca* and *Spirodella polyrhiza* (25 - >75 cm). Localised beds of *Potamogeton pusillus* were recorded in S1, S3 and S4 (25 – 150 cm), while *Potamogeton obtusifolius* was observed only occasionally, in S1 and S2 between 75 – 160 cm. *Potamogeton pectinatus* appears to be no abundant than it was in 1990, with a low frequency of 10% in S2 and S3 (110 – 150 cm). *Ranunculus circinatus* and *Ranunculus aquatilis* were both common in S1, but appearing only occasionally in S2 (50 - ~120 cm). Localised beds of *Chara globularis* were observed in S1 and 3 between 75 – 130 cm, while *Fontinalis antipyretica* and *Callitriche hermaphroditica* were recorded with a rare abundance in S1 and S4. *Elodea nuttallii* had completely dominated the majority of the sections surveyed, recorded across depths between 25 – 200 cm, with an overall abundance of "4" (on a 1-5 scale). Aquatic macrophytes were found growing to a maximum depth of 2.0 m. A full species list is given in Table 270 below.

Water quality

Table 268 Water chemistry data for Drumcullion Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1990
TP	105.0	142.0	160.0	166.0	**143.25**	196
SRP	61.7	99.8	119.0	146.0	**0.107**	180
TN	1.49	0.99	1.95	3.01	**1.86**	1.57
TON	0.611	0.047	0.842	1.600	**0.775**	-
Nitrite	0.015	0.003	0.028	0.013	**0.015**	-
Chl *a*	5.06	1.73	1.65	1.54	**2.49**	6.83
DOC	7.81	8.22	10.10	8.21	**8.59**	-
pH	8.13	8.41	7.90	7.88	**8.03**	7.83
Alk	127	125	123	109	**121**	71.5
Cond	295	287	305	319	**301**	359
Ca^{2+}	44.10	42.10	45.90	43.40	**43.88**	51
Mg^{2+}	5.62	6.32	6.55	5.73	**6.06**	6.6
Na^{+}	10.30	11.00	11.30	14.60	**11.80**	13.25
K^{+}	4.94	5.32	6.16	4.88	**5.33**	4.6
Cl^{-}	18.70	18.10	19.50	28.70	**21.25**	26.09
SO_4^{2-}	<10	9.87	14.50	13.50	**11.97**	16.31

Drumcullion Lough is a very shallow (Z_{max} recorded = 2.2 m) eutrophic lake with high annual mean TP (143.25 μgl^{-1}) which classifies it as "unfavourable" with respect to trophic status. The mean annual chlorophyll *a* concentration is within the acceptable range for the lake type. In summer 1990, a spot water sample recorded a TP concentration of 196 μgl^{-1}, and although no firm conclusions can be drawn from these two sets of independent data, TP concentrations between 1990 and 2014 look stable. At the time of survey, there was a technical problem with the DO meter, so it was not possible to measure O_2 levels in the water column.

Hydrology
Drumcullion Lough is hydrologically connected to Upper Lough Erne via a stream to the southwest of the water body. The hydrological regime at the site appears natural.

Lake substrate
The lake substrate is predominantly silty in the deeper water areas, which is consistent with the underlying geology and alluvial soils in the catchment. The substrate predominantly comprises root mass at water depths ≤75 cm.

Sediment load
There is some poaching of the lake shore and grazing was observed at the time of survey. However, an increase in sediment load was not evident.

Indicators of local distinctiveness
Eleocharis acicularis (nationally restricted distribution) and *Littorella uniflora* were recorded in 1990 but not in the 2014 survey. No other indicators of local distinctiveness are known.

Summary
Drumcullion Lough fails to achieve its macrophyte species compositional targets, with only five characteristic species present in less than 60% of all plots and the abundance of *E. nuttallii* (97%) is exceptionally high. The abundance of species between 1990 and 2014 appears to have changed significantly. The variety of broad-leaved *Potamogeton* species has decreased: *P. crispus, P. natans* and *P. x angustifolius* (*x zizii*) were noticeably absent from the recent survey and with concern *L. uniflora* was also not recorded. All the above observations suggest enrichment. In addition to the floristic composition, the annual mean TP concentration was exceptionally high in 2014, and the spot sample taken in 1990 suggests this to have been the case for at least 25 years.

Considering these factors, particularly the high frequency of *E. nuttallii,* Drumcullion Lough's condition is classed as **unfavourable.** Diffuse pollution from surrounding farmland and settlements within the catchment may be contributing to the lough's high trophic status. Diffuse sources of pollution should be investigated and monitored to ensure that the lough's condition does not deteriorate further. Zebra mussels were recorded in the lough during the 2014 survey and these may be detrimental to its condition – populations and their impact upon lake ecological status should be monitored.

Table 269 Drumcullion Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Drumcullion Lough NI Lake 760	**Unfavourable**	High mean annual TP concentration (143 μgl^{-1}). Possible loss of *L. uniflora* since 1990; absence of multiple *Potamogeton* spp. and high abundance of *E. nuttallii* all suggest enrichment. Zebra mussels present. Some poaching of lake shores noted.	Species-rich aquatic macrophyte flora - 5 characteristic species. 42% of wader / boat sample spots record ≥1 characteristic spp.). Abundance of *E. nuttallii* high.

Species list

Table 270 List of all plant species recorded at Drumcullion Lough: 2014

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	F
Alisma plantago-aquatica	R
Alnus glutinosa	R
Apium nodiflorum	R
Caltha palustris	R
Carex rostrata	R
Eleocharis palustris	R
Epilobium hirsutum	O
Equisetum fluviatile	R
Filipendula ulmaria	O
Galium palustre	R
Hydrocotyle vulgaris	O
Impatiens glandulifera	R
Iris pseudacorus	R
Juncus articulatus	R
Juncus effusus	F
Juncus inflexus	R
Lotus corniculatus	R
Lycopus europaeus	R
Lysimachia nummularia	R
Lythrum salicaria	R
Mentha aquatica	O
Menyanthes trifoliata	R
Myosotis scorpioides	O
Phalaris arundinacea	R
Phragmites australis	F
Potentilla anserina	F
Ranunculus lingua	R
Rorippa sylvestris	R
Salix sp.	R
Schoenoplectus lacustris	F
Sparganium erectum	F
Valeriana dioica	R
Veronica beccabunga	R

Submerged & floating species	% Frequency (n = 145)
Callitriche hermaphroditica	3
Chara globularis	13
Elodea nuttallii	97
Fontinalis antipyretica	1
Lemna minor	57
Lemna trisulca	54
Nuphar lutea	41
Potamogeton obtusifolius	4
Potamogeton pectinatus	10
Potamogeton pusillus	12
Ranunculus aquatilis	10
Ranunculus circinatus	11
Spirodela polyrhiza	21

Survey data

Site Condition Assessment: Drumcullion Lough (07/07/2014)

Lake Details		Survey Details		
Lake Name	Drumcullion Lough	Survey Date	07/07/2014	
SSSI Name		Surveyors	SG, EA	
SAC Name		Shore Surveys	4	out of
Grid Ref (centre)	H275397	Wader Surveys	4	4
WBID / NI No.	50073 / 760	Boat Surveys	4	sections

Site Notes:

Survey Notes:
S1: 25cm all too difficult to reach - deep silt and thick vegetation. DO not recorded as meter was broken.
S1,P1&2, 25cm: impossible to see submerged due to lemna cover and access

Section Summaries

Section 1	Maximum depth of colonisation (cm)	190 cm
	Compass bearing of boat transect (°)	150 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes: Chara A: H2766239376 (52)	
Section 2	Maximum depth of colonisation (cm)	190 cm
	Compass bearing of boat transect (°)	230 °
	Lateral distance from waters edge to 75cm depth (m)	5 m
	Notes: Zebra mussels found on boat survey	
Section 3	Maximum depth of colonisation (cm)	200 cm
	Compass bearing of boat transect (°)	320 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes:	
Section 4	Maximum depth of colonisation (cm)	180 cm
	Compass bearing of boat transect (°)	48 °
	Lateral distance from waters edge to 75cm depth (m)	15 m
	Notes: P4 - A lot of Pot pec on strandline	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H2768639364	H2761939444	H2764639400	H2751139500
Section 2	H2751039417	H2742239489	H2746739441	H2750539489
Section 3	H2748939962	H2752240053	H2750740014	H2754439999
Section 4	H2773440005	H2770240061	H2773240042	H2769040016

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0035	0036	0037
Section 2	0048	0049	0050
Section 3	0051	0052	0053
Section 4	0054	0055	0057

3.53. Coole Lough (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	01 July 2014
NI Lake Number:	765
WBID:	50123
County:	Fermanagh
Grid reference:	H255435
OS Grid reference (X,Y):	225490,343478
Shoreline development index:	1.179
Surface area (ha.):	12.3
Maximum recorded depth (m):	3.9

Table 271 Condition Assessment Summary Table for Coole Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	**X**	3 characteristic species present in 2014: *C. globularis, P. friesii & P. filiformis.*
	No loss of characteristic species	✓**?**	*P. perfoliatus* recorded in the NILS survey in the 1980's, not recorded in current survey. Methods not directly comparable.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	50% of vegetated sample spots comply
Negative indicator species	Negative indicator species absent or at a low frequency	**X**	*Elodea canadensis* recorded at 59.5% of submerged sample points. Zebra mussel (*Dreissena polymorpha*) also recorded.
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 59.5% of submerged sample points. Zebra mussel (*Dreissena polymorpha*) also recorded.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	0% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	*P. australis* and *S. lacustris* dominate the reed fringe around the lough, interspersed with *T. latifolia*, *S. erectum* and *C. rostrata*. *N. lutea* zone beyond the reeds up to 2.5m. *P. friesii* dominant up to 2.3m. *L. trisulca* smothers vegetation up to 0.75m, less dense beyond this depth. *F. antipyretica* abundant in section 3 growing in a floating mat on the surface in places. *Charophytes* present at ~ 2m depth.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 3.9 m; Z_s = 2.7m; Z_v = > 3.4 m.
	At least the present structure should be maintained	✓	No change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 35 μgl^{-1}	✓	TP = 30.2 μgl^{-1} (14 - 60 μgl^{-1}) & TN = 0.76 mgl^{-1} (Apr'14 – Feb'15)
	Stable pH / ANC values: pH >7.00 & <9.00	✓	pH = 7.96 (range = 7.85 – 8.08)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	✓	Water column mixed and well oxygenated. Mean DO = 7.67 mgl^{-1}. No clear thermocline.

Attribute	Target	Status	Comment
	No excessive growth of cyanobacteria or green algae	✓	None noted
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓?	*P. filiformis* present and high frequency of *P. friesii*.
	Minimal negative impacts and no fish farming	✓?	Golf course nearby and moderate grazing pressure.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 12.3 ha, with no loss of extent of open water.

Macrophyte community composition

Coole Lough has a moderate diversity of macrophyte taxa with this survey recording 14 species of submerged and floating leaved taxa. Five *Potamogeton spp.* were recorded including; *Potamogeton filiformis,* which is notable, as although locally common it is nationally rare, but it may be under recorded. *Potamogeton friesii* was abundant, forming dense beds at around 1-2m depth.

The NI lake survey (NILS) recorded a very similar set of species at Coole Lough as the current survey. Notable differences were the presence of *Potamogeton perfoliatus* and *Potamogeton berchtoldii* in 1990 but absent in the current survey. *Potamogeton filiformis* and *Nitella flexilis agg.* were recorded in the current survey but not in the NILS survey. All other aquatic species were present in both surveys, which were performed using different methodologies.

Elodea canadensis was present at high frequency (60%) throughout the lough. This species was also recorded in the NI lake survey in 1990 at an abundance of "4" on a 1-5 scale, and therefore its prevalence at the lough is by no means a recent phenomenon. It is unknown if the long-term presence of *Elodea canadensis* has had a negative impact on other species, but it occupies similar water depths to *Potamogeton perfoliatus* and *Potamogeton berchtoldii,* and may therefore have contributed to their decline and possible loss from the site. The current frequency of *E. canadensis* is unfavourable.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated from the NILS 1990 data, suggesting that the tropic status is stable. The margins were heavily shaded by woodland around

most of the lough which probably explains the low diversity of marginal species (Table 272).

Negative indicator species

Elodea canadensis was found at 59.2% frequency in the current survey, found at up to 2.2m. Despite its proximity to Lough Erne, *Elodea nuttallii* was not recorded.

Zebra mussel (*Dreissena polymorpha*) was also recorded in the current survey. Zebra mussels are abundant in Lough Erne and its satellite loughs.

Table 272 Aquatic macrophyte community composition for Coole Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=111)***
Chara contraria	**8.5**	**7.69**	**+**	**-**	**-**	**-**
Chara globularis	**8.5**	**7.69**	**+**	**8.5**	**7.69**	**6.3**
Elodea canadensis	8.5	7.95	4	8.5	7.95	59.5
Fontinalis antipyretica	-	-	-	6.3	5.38	34.5
Lemna trisulca	10.0	8.85	5	10.0	8.85	61.3
Lemna minor	9.0	8.85	3	9.0	8.85	5.4
Myriophyllum spicatum	10.0	8.85	5	10.0	8.85	+
Nitella flexillis agg.	-	-	-	5.5	5.38	7.2
Nuphar lutea	8.5	6.92	4	8.5	6.92	44.1
Potamogeton alpinus	5.5	5.38	3	5.5	5.38	2.7
Potamogeton berchtoldii	7.3	7.69	1	-	-	-
Potamogeton filiformis	**-**	**-**	**-**	**10.0**	**7.69**	**+**
Potamogeton friesii	**-**	**-**	**1**	**10.0**	**9.26**	**46.8**
Potamogeton natans	6.7	4.23	1	6.7	4.23	0.9
Potamogeton pectinatus	10.0	8.85	1	10.0	8.85	15.3
Potamogeton perfoliatus	**7.3**	**7.69**	**1**	**-**	**-**	**-**
Average score	**8.3**	**7.55**		**8.3**	**7.33**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Macrophyte community structure

Coole Lough is bordered by reed beds that are dominated by *S. lacustris* and *P. australis*, with occasional *T. latifolia*, *C. rostrata* and *S. erectum*. The lough is surrounded by deciduous woodland and beyond that rough pasture and a golf course. Beyond the reed fringe a *N. lutea* zone is present up to ~1m although occasional plants were growing up to a depth of 2.2m. Beyond the *N. lutea* zone *P. friesii* was dominant up to 2.5m where it grew as a dense mat with *E. canadensis* , *N. flexilis agg*. and *L. trisulca* present within this matrix. *F. antipyretica* was generally

present in low abundance apart from in section 3 where it was present in such abundance that is occupied the whole water column and was floating on the surface. A single *P. filiformis* plant was found near section 3 on an exposed rocky shore but none was recorded in the survey sections. The habitat throughout most of the lough would seem unsuitable for this species.

Water quality

Coole Lough is a shallow (Z_{max} recorded = 3.8 m), eutrophic lake with an annual mean TP (30.2 μgl^{-1}) which is within the guideline levels for this type of lake (JNCC 2015) and classifies it as "favourable" with respect to trophic status. No filamentous algae was recorded nor were any algal blooms. Chlorophyll *a* levels are also low. Very high TP, TN and Chlorophyll *a* readings from the 1990 NILS survey suggests that this lake has suffered from excessive nutrient inputs in the past. The upper 2.0 m of the water column was well oxygenated (mean= 7.67 mgl^{-1}), dropping to less than 5 mgl^{-1} below 3.0 m (Figure 58). No clear thermocline was apparent on the day of the survey.

Table 273 Water chemistry data for Coole Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1990
TP	14.2	60.1	29.9	16.6	**30.2**	194
SRP	1.9	1.1	6.4	1.8	**2.8**	13
TN	0.001	<0.001	0.002	0.004	**<0.002**	2.66
TON	0.009	<0.005	0.045	0.306	**<0.091**	-
Nitrite	0.001	<0.001	0.002	0.004	**<0.002**	-
Chl *a*	0.73	5.60	20.79	0.60	**6.93**	48.2
DOC	6	6.21	5.83	5.82	**5.97**	-
pH	7.93	8.08	7.85	8.02	**7.96**	8.26
Alk	141	147	138	138	**141**	57
Cond	297	275	278	306	**289**	294
Ca^{2+}	53.8	48.8	51.9	53.4	**52.0**	41.2
Mg^{2+}	3.81	3.84	3.81	3.67	**3.78**	4.2
Na^{+}	7.91	7.94	7.82	8.89	**8.14**	11.6
K^{+}	1.17	1.12	1.18	1.3	**1.19**	1
Cl^{-}	13.8	14.1	14	16.7	**14.7**	19.6
SO_4^{2-}	<10	3.53	4.67	10.2	**<7.1**	13.1

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty. *Potamogeton filiformis* was found only on hard substrates (gravels and pebbles) limited to the north shore.

Sediment load

The dominant land cover in the catchment is rough pasture, and mixed woodlands, although close to the south side of the lough there is a golf course which lies within the lake catchment. Disturbance appears to be relatively low around most of the lough and the sediment load appears natural throughout the majority of the lough.

Indicators of local distinctiveness

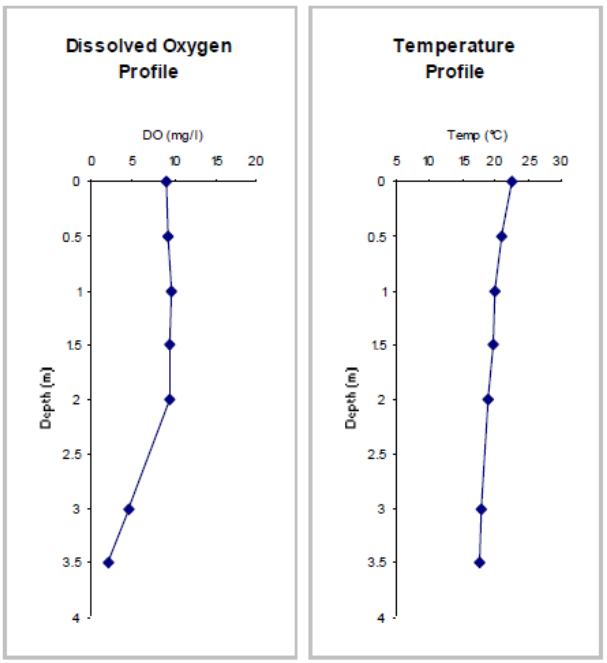
Potamogeton filiformis was present on an exposed rocky section of the northern shore. This species was not recorded in the NILS 1990 survey. *Potamogeton friesii* was abundant in this survey and present in the NILS 1990 survey.

Figure 58 Dissolved oxygen and temperature profile for Coole Lough (01/07/2014)

Dissolved Oxygen Profile

GPS Location	H2542143471
Maximum Depth (m)	3.9 m
Secchi Depth (cm)	270 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.97	22.5
0.5	9.27	21
1	9.66	20
1.5	9.58	19.6
2	9.48	19
3	4.63	17.9
3.5	2.12	17.7



Summary

Coole lough has a reasonable aquatic macrophyte assemblage with 3 characteristic species and 14 aquatic species overall recorded in the most recent survey. *Potamogeton filiformis* is a notable species as it is nationally rare. No broad-leaved *Potamogeton* spp. were recorded with *P. perfoliatus* being apparently absent from the most recent survey but recorded in the NILS survey in the 1980's. In places the macrophyte growth was so extensive that it occupied the whole water column with a matrix of *P. friesii*, *L. trisulca* and *E. canadensis* forming a dense matt completely obscuring the lake bed. This abundant growth could be interpreted as a sign of eutrophication but this isn't backed up by the water chemistry data. TP levels are within the guideline levels for this type of lake (JNCC 2015) and no filamentous algae or algal blooms were observed. Chlorophyll a levels were also low.

The macrophyte community was similar to that recorded in the NILs survey suggesting that the site is stable. Invasive species were present with *E. canadensis*

frequent and Zebra mussels (*Dreissena polymorpha*) recorded up to a depth of 1.9m. The margins were predominantly occupied by overhanging broadleaved trees and as a result the marginal flora is not very diverse due to shading. Despite Coole Lough showing many favourable characteristics of an Eutrophic lake, notable water quality, the small number of characteristic species and presence of invasive species results in the lake being classed in an **Unfavourable condition.**

Table 274 Coole Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Coole Lough NI Lake 765	**Unfavourable**	Only 4 characteristic species present and no broad leaved *Potamogeton spp. E. canadensis* abundant and Zebra mussel present.	The site exhibits good water quality and relatively low nutrient levels. The macrophyte community appears stable, but the loss of key characteristic species is of concern.

Species list

Table 275 List of all plant species recorded at Coole Lough

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	F
Alnus glutinosa	O
Equisetum fluviatile	O
Sparganium erectum	O
Phalaris arundinacea	R
Iris pseudacorus	R
Typha latifolia	R
Scutellaria galericulata	R
Schoenoplectus lacustris	R
Carex rostrata	R
Menyanthes trifoliata	R
Potentilla palustris	R
Salix sp.	R
Cicuta virosa	R
Epilobium hirsutum	R
Solanum dulcamara	R
Mentha aquatica	R
Submerged & floating species	**% Frequency (n = 111)**
Chara globularis	6
Elodea canadensis	60
Fontinalis antipyretica	35
Lemna trisulca	61
Lemna minor	5
Myriophyllum spicatum	+
Nitella flexillis agg.	7
Nuphar lutea	44
Potamogeton alpinus	3
Potamogeton filiformis	+
Potamogeton friesii	47
Potamogeton natans	1
Potamogeton pectinatus	15

Survey data

Site Condition Assessment: Coole Lough (01/07/2014)

Lake Details		Survey Details		
Lake Name	Coole Lough	Survey Date	01/07/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	3	out of
Grid Ref	H255435	Wader Surveys	3	3
WBID / NI No.	50123 / 765	Boat Surveys	3	sections

Site Notes:

Survey Notes:
Zebra Mussel present

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	340 cm
		Compass bearing of boat transect (°)	190 °
		Lateral distance from waters edge to 75cm depth (m)	15 m
		Notes: Zebra Mussel present in boat section @ 1.9m	
Section	**2**	Maximum depth of colonisation (cm)	280 cm
		Compass bearing of boat transect (°)	320 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**3**	Maximum depth of colonisation (cm)	340 cm
		Compass bearing of boat transect (°)	42 °
		Lateral distance from waters edge to 75cm depth (m)	-
		Notes: Z. Mussel found >75cm. Extensive Fontinalis growth	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H2555443265	H2046043287	H2550143281	H2547343323
Section	**2**	H2532443396	H2530343500	H2530443440	H2531043456
Section	**3**	H2550443679	H2560543667	H2555143664	H2553743613

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0131	0134	0133
Section	**2**	0135	0136	0137
Section	**3**	0141	0143	0146

3.54. Killee Lough (HA Sh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	08 July 2014
NI Lake Number:	810
WBID:	50364
County:	Fermanagh
Grid reference:	H294504
OS Grid reference (X,Y):	229397,350417
Shoreline development index:	1.02
Surface area (ha.):	3.1
Maximum recorded depth (m):	3.8

Table 276 Condition Assessment Summary Table for Killee Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species and 1 broad-leaved *Potamogeton* spp.	**X**	1 characteristic species present in 2014: *Potamogeton alpinus*
	No loss of characteristic species	**X**	. *Potamogeton praelongus* recorded in 1988 but not in 2014.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic spp.	**X**	7% of vegetated sample spots comply

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	✓**?**	*Elodea canadensis* recorded at 42.4% of vegetated, submerged sample points. In 1988 the abundance of *E. canadensis* was also high ('5' on a 1-5 scale).
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	9.2% of all points scored with a '3' for filamentous algae
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Excellent marginal habitat dominated by reeds and sedges. Entire site fringed by *Phragmites australis*, *Schoenoplectus lacustris* & *Equisetum fluviatile* (also *C. elata* and *C. nigra* with *J. articulatus* and *J. effusus*) on the shore side & *C. rostrata* towards the water. Numerous other emergent species: *Caltha palustris, Hydrocotyle vulgaris* and *Menyanthes trifoliata* most abundant. Submerged and floating leaved flora less species rich; *N. alba* abundant in S2 (50-260 cm) and *N. lutea* abundant in S1 (25-75 cm). *Lemna* spp. interspersed throughout vegetation zones. *P. alpinus* in S1 & 2 (25- >75 cm) and *P. natans* only in S1 at 25 cm. *E. canadensis* abundant in S1 (25-140 cm) and occasional in S2 (50- >75 cm).
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 3.8 m, Z_s = 1.3 m, Z_v = 2.6 m.
	At least the present structure should be maintained	✓	Hydrosere present – no change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	✓	TP = 39.1 μgl^{-1} (range = 27-52) & TN = 1.0 mgl^{-1} (April '14 – Feb. '15)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.6 (range = 7.4 – 7.7)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	-	Technical fault with DO meter – not recorded.
	No excessive growth of cyanobacteria or green algae	✓	No blooms present. Water clear.
Hydrology	Natural hydrological regime	✓	Appears natural.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of increased sediment loads although poaching observed on the shore.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	None previously recorded.
	Minimal negative impacts and no fish farming	✓?	Poaching of shoreline observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 3.1 ha, with no loss of extent of open water.

Macrophyte community composition

Killee Lough has a limited submerged and floating leaved aquatic macrophyte flora both overall (9 species) and with respect to the representation of characteristic species (1 species – *P. alpinus*). However the site does have rich marginal and emergent flora (see following section) which comprises the majority of the total number of species in 2014, which is 38. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 7.4 and 6.33 respectively (Table 277). When the scores are compared to those calculated from the 1988 survey data (7.5 and 5.59 respectively), there is little change in TRS scores, but an increase in PLEX scores. It is therefore possible that Killee Lough has decreased in alkalinity since 1988 (Duigan, 2006). One characteristic species was recorded in 1988, which has since not been observed in the lough, *P. praelongus*. *Lemna minor* and *L. trisulca* were recorded in 2014, which are additional species since 1988. All other species recorded in 2014 remain consistent with the macrophyte composition of 26 years ago. Although the survey methods used in 1988 and 2014 do not produce data that are directly comparable, there would appear to have been a net gain in the overall number of submerged / floating leaved species since 1988, albeit at low to very low abundances.

Negative indicator species

Elodea canadensis was recorded as abundant in 1988 (“5” on a 1-5 abundance scale) and in 2014 it was recorded at an overall frequency of 42%, suggesting that this non-native species has been a significant component of Killee Lough’s aquatic macrophyte community for at least the last 26 years. Although the impact this may have had is uncertain, such a persistent population within the flora is deemed as unfavourable.

Table 277 Aquatic macrophyte community composition for Killee Lough, including trophic scores

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=59)***
Elodea canadensis	8.5	7.95	5	8.5	7.95	42.4
Fontinalis antipyretica	-	-	-	6.3	5.38	35.6
Lemna minor	-	-	-	9.0	8.85	8.5
Lemna trisulca	-	-	-	10.0	8.85	1.7
Menyanthes trifoliata	-	-	-	5.3	-	20.3
Nuphar lutea	-	-	-	8.5	6.92	3.4
Nymphaea alba	6.7	3.08	2	6.7	3.08	35.6
Potamogeton alpinus	**5.5**	**5.38**	**4**	**5.5**	**5.38**	**6.8**
Potamogeton natans	6.7	4.23	**3**	6.7	4.23	1.7
Potamogeton praelongus	**7.3**	**5.38**	**1**	**-**	**-**	**-**
Sparganium emersum	10.0	7.50	2	-	-	-
Average score	**7.5**	**5.59**		**7.4**	**6.33**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Killee Lough is bound by rough pasture along the majority of its northern shore and by a wetland on the south shore. The wetland comprises of a quaking bank which transitions into an area of wet meadow. The marginal zone of the lake makes an excellent habitat, dominated by a wide range of emergent species including reeds and sedges. *Carex elata* and *Carex nigra* were frequently encountered in the margins, as well as *J. articulatus, J. effusus* and *Myosotis scorpiodes.* Numerous other emergent species fringing the water were also recorded: *P. australis, S. lacustris, E. fluviatile, C. palustris, H. vulgaris* and *M. trifoliata* were the most abundant. *Scirpo-Phragmitetum* communities grow in a continuous band around much of the lake, extending to depths of approximately 1.6 m. Beyond this, an open plant community is dominated by floating-leaved species; *Nuphar lutea* was found to be abundant in Section 1, growing from 25 to 75 cm depths. *Potamogeton natans* was also recorded in the vicinity, but at a very low frequency at a depth of 25 cm. Section 2 was dominated by *Nymphaea alba* from 50 – 260 cm, interspersed with *Lemna* spp. *Potamogeton alpinus* was recorded in both sections in the shallower waters of 25 – >75 cm. *Elodea canadensis* and *Fontinalis antipyretica* were found to be most abundant on the eastern side of the lough (S1), recorded with frequent occurrence in depths of 25 – 190 cm. A full species list is given in Table 280 below.

Water quality

Killee Lough is a shallow (Z_{max} recorded = 3.8 m), eutrophic lake with relatively high annual mean TP (39 $\mu g l^{-1}$), but is within the limits set for very shallow sites of this type and is therefore “favourable” with respect to trophic status under the CSM

(2015) guidelines. In summer 1988, a spot water sample recorded a TP concentration of 37 μgl^{-1}, a TN concentration of 0.78 mgl^{-1} and a Chl *a* concentration of 4.4 μgl^{-1}. Although no firm conclusions can be drawn from these two sets of independent data, TP and Chl *a* concentrations between 1988 and 2014 appear to have remained relatively stable. At the time of survey, there was a technical fault with the DO meter, rendering it unusable. As a result, oxygen levels were not recorded.

Table 278 Water chemistry data for Killee Lough

	Apr '14	Aug. '14	Nov. '14	Feb. 15	Mean	1988
TP	27.4	41.0	52.3	35.8	**39.1**	37
SRP	5.0	1.0	11.0	15.0	**8.0**	3.0
TN	0.69	0.95	1.43	0.94	**1.00**	0.78
TON	0.005	0.053	0.339	0.322	**0.180**	-
Nitrite	0.001	0.004	0.008	0.003	**0.004**	-
Chl *a*	4.73	9.02	6.38	1.91	**5.51**	4.4
DOC	8.48	10.40	13.20	7.88	**9.99**	-
pH	7.69	7.42	7.63	7.50	**7.55**	7.51
Alk	55	77	70	46	**62**	49
Cond	137	179	175	157	**162**	153
Ca^{2+}	20.10	28.30	27.50	19.60	**23.88**	14.4
Mg^{2+}	1.90	2.56	2.47	2.26	**2.30**	2.4
Na^{+}	6.31	6.84	7.25	9.47	**7.47**	7.5
K^{+}	1.30	1.88	2.80	2.08	**2.02**	1.2
Cl^{-}	10.90	11.30	12.90	20.00	**13.78**	16.91
SO_4^{2-}	<10	4.76	7.01	5.04	**<6.70**	8.15

Hydrology
The hydrological regime at the site appears natural.

Lake substrate
Organic materials dominate in the marginal areas to a water depth of ~75 cm. In deeper water areas the substrate predominantly comprises silts.

Sediment load
The entire lough has a reed and sedge dominated wetland fringe, which would reduce the impact of any increase in catchment sediment loads. At the time of survey the water clarity was good, but there was some evidence of livestock poaching along the margins of the lough.

Indicators of local distinctiveness
No indicators of local distinctiveness have historically been specified or have currently been observed.

Summary

Killee Lough is in **unfavourable** condition due to a poorly represented characteristic flora. The lough nonetheless supports a species rich marginal and emergent floral community and the overall species composition has changed very little since 1988, suggesting that the aquatic plant community is stable. Only one characteristic species was recorded in 2014, *P. alpinus*, which was recorded in the 1988 assemblage, alongside *P. praelongus*. However, the survey methods used in 1988 and 2014 do not produce data that are directly comparable due to the different methods employed for each survey. The water chemistry appears to have remained stable over the past 26 years, and TP and TN are within the acceptable range set by CSM (2015) standards for a lake of this type and depth.

The occurrence of *E. canadensis* at relatively high abundance since 1988 is also unfavourable.

Table 279 Killee Lough: overview

Water Body	Status	Reason(s) for Failure	Comments
Killee Lough NI Lake 810	Unfavourable	Only 1 characteristic species present Possible loss of 1 characteristic species since 1988 *E. canadensis* present at high abundance	Marginal and emergent flora is species rich. Limited aquatic macrophyte assemblage but appears to have remained stable since 1988. Moderate frequency of *E. canadensis* may not be detrimental to overall site condition. Nutrient levels appear to have remained stable since 1988 and are favourable.

Species list

Table 280 List of all plant species recorded at Killee Lough

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	F
Alnus glutinosa	R
Angelica sylvestris	R
Caltha palustris	F
Carex elata	R
Carex nigra	R
Carex rostrata	F
Eleocharis palustris	R
Epilobium hirsutum	R
Equisetum fluviatile	F
Filipendula ulmaria	O
Fontinalis antipyretica	F
Galium palustre	O
Glyceria fluitans	R
Hydrocotyle vulgaris	O
Hypericum tetrapterum	R
Juncus articulatus	O
Juncus effusus	F
Lychnis flos-cuculi	R
Mentha aquatica	F
Menyanthes trifoliata	F
Myosotis scorpioides	F
Nuphar lutea	R
Phragmites australis	F
Potamogeton natans	R
Potentilla palustris	O
Ranunculus flammula	R
Ranunculus lingua	R
Salix sp.	O
Schoenoplectus lacustris	A
Sparganium erectum	R
Sphagnum sp.	O
Veronica beccabunga	R

Submerged & floating species	Frequency (n = 59)
Elodea canadensis	25
Fontinalis antipyretica	21
Lemna minor	5
Lemna trisulca	1
Nuphar lutea	2
Nymphaea alba	21
Potamogeton alpinus	4
Potamogeton natans	1

Survey data

Site Condition Assessment: Killee Lough (08/07/2014)

Lake Details		**Survey Details**		
Lake Name	Killee Lough	Survey Date	08/07/2014	
SSSI Name		Surveyors	SG, EA	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H294504	Wader Surveys	2	2
WBID / NI No.	50364 / 810	Boat Surveys	2	sections

Site

Survey
DO meter not working hence not completed

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	190 cm
		Compass bearing of boat transect (°)	120 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	260 cm
		Compass bearing of boat transect (°)	250 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H2946150497	H2946750393	H2947150444	H2942850438
Section	**2**	H2959150430	H2934150346	H2930650386	H2933950402

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0038	0040	0039
Section	**2**	0041	0043	0042

3.55. Round Lough (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	28 June 2014
NI Lake Number:	835
WBID:	50353
County:	Tyrone
Grid reference:	H443484
OS Grid reference (X,Y):	244302,348410
Shoreline development index:	1.142
Surface area (ha.):	3.3
Maximum recorded depth (m):	6.7 m

Table 281 Condition Assessment Summary Table for Round Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	**X**	2 characteristic species present in 2014: *Potamogeton alpinus* & *P. praelongus*
	No loss of characteristic species	**X**	*Potamogeton crispus* and *Charophytes* recorded in 1988 but not in 2014.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	19% of vegetated sample spots comply (7% wader, 39% boat).

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 23% of submerged sample points.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	0% of sampling points scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Good marginal habitat consisting of reeds and sedges, with wet broadleaf woodland to the northeast. Diverse submerged and floating leaved vegetation. *M. trifoliata* frequent in S1-3 (25-75 cm). *N. lutea* most common (50-250 cm), *N. alba* frequent only in deeper depths (100-220 cm). *L. trisulca* frequent in S1-3 (25-220), *L. minor* only S1 in shallows. *P. alpinus* occasional S1-3 (75->75 cm), *P. praelongus* in S1-3 (25-170 cm), *S. emersum* common in deeper waters (75 – 235 cm). *F. antipyretica* only S3 (25 – 235 cm). *E. canadensis* not frequent across S1-3 (50->75). *P. natans* observed in strandline of S2 & 3. Good evidence for characteristic vegetation zonation.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 6.7 m, Z_s = 1.7 m, Z_v = 2.5 m.
	At least the present structure should be maintained	✓	Hydrosere present – no change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 37.6 μgl^{-1} (range 35.3 – 43.4) & TN = 1.00 mgl^{-1} (April '14 – Feb. '15)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.9 (range = 7.87 – 7.89)
	Adequate dissolved O_2 throughout the water column (mean > 6 ml^{-1} below thermocline)	**X**	Waters well oxygenated from 0 – 2 m (> 5 mgl^{-1}). Mean DO below the thermocline (below 3m) was 0.33 1 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	No surface blooms present but water turbid.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None noted
	Minimal negative impacts and no fish farming	✓?	No poaching present although grazing observed on southern shore side. Shore angling and some litter observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 3.3 ha, with no loss of extent of open water.

Macrophyte community composition

Table 282 Aquatic macrophyte community composition for Round Lough, including trophic scores.

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=74)***
Charophytes	8.5	7.69	1	-	-	-
Elodea canadensis	8.5	7.95	4	7.3	7.95	23.5
Fontinalis antipyretica	6.3	5.38	1	6.3	5.38	9.2
Lemna minor	9.0	8.85	2	9.0	8.85	1
Lemna trisulca	10.0	8.85	2	10.0	8.85	53.1
Menyanthes trifoliata	-	-	-	5.3	-	18.4
Nuphar lutea	8.5	6.92	3	8.5	6.92	73.5
Nymphaea alba	6.7	3.08	4	6.7	3.08	12.2
Potamogeton alpinus	**5.5**	**5.38**	**2**	**5.5**	**5.38**	**10.2**
Potamogeton crispus	**8.5**	**7.95**	**4**	**-**	**-**	**-**
Potamogeton praelongus	**-**	**-**	**-**	**7.3**	**5.38**	**19.4**
Sparganium emersum	10.0	7.50	3	10.0	7.5	29.6
Potamogeton natans	6.7	4.23	5	6.7	4.23	+
Average score	**7.8**	**6.79**		**7.8**	**6.35**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes taxa recorded as present at the site but not found growing in the survey sections

Round Lough has a species rich submerged and floating leaved aquatic macrophyte flora overall, with a good marginal habitat. However, it fails to meet the necessary criteria for characteristic species for a site of this type, with only two present in 2014: *Potamogeton alpinus* and *P. praelongus* (JNCC 2015). The mean Trophic Rank

Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 7.8 and 6.35 respectively (Table 282). The TRS and PLEX scores are almost identical to those recorded in 1988, suggesting there has been little change at the lough over this period. However, two characteristic species recorded in the 1988 survey were not seen in 2014 (abundances in 1988 are in brackets): *Potamogeton crispus* (abundant) and *Charophytes,* including *Chara globularis var. virgata* (rare). Considering the low frequency of *Chara* spp. recorded in the 1988 survey, it is possible that it is still growing in Round Lough and was simply not detected in the recent survey. Comparison of the 1988 and 2014 data should be treated with caution due to the differing survey methods used. Species recorded in 2014, but not in 1988 were *Menyanthes trifoliata* and *Potamogeton praelongus*, both of which were frequent.

Negative indicator species

Elodea canadensis was recorded as abundant in 1988 ("4" on a 1-5 abundance scale) and in 2014 it was recorded at an overall frequency of 23%, suggesting that although this species has been a component of Round Lough's aquatic macrophyte community for at least the last 26 years, it is not growing at a sufficient abundance to classify the site as unfavourable. Minimal filamentous algal cover was recorded in the 2014 survey.

Macrophyte community structure

Round Lough is bounded by a good marginal habitat of reeds and sedges, with broadleaf woodland on the north-eastern bank consisting of *Alnus glutinosa* and *Salix* spp. *Scirpo-Phragmitetum* communities are found in a narrow band around much of the lake comprising mainly of *Phragmites australis* with significant abundances of *Schoenoplectus lacustris, Equisetum fluviatile* and *Carex rostrata,* and to a lesser extent *Cladium mariscus* and *Cicuta virosa.* This community extends into water depths of approximately 0.25 – 1.0 m. *Menyanthes trifoliata* was recorded growing successfully within this plant community, observed frequently at depths between 0.25 – 0.75 m. *Carex disticha* and *Carex paniculata* are also occasional sedges found growing within the margins of the lake.

There is a species rich open water submerged plant community, of which *Nuphar lutea* is dominant in depths between 0.5 – 2.5 m. *Nymphaea alba* was frequently recorded at greater depths of 1 – 2.2 m, interspersed by *Lemna trisulca* in all three sections from 0.25 – 2.2 m. *Lemna minor* was only recorded in the shallows in S1 at 0.75 m. *Potamogeton alpinus* was recorded with rare abundance within all survey sections, at shallower depths of 0.75 - >0.75 m. *Potamogeton praelongus* was frequent in all sections between 0.25 – 1.7 m, as was *Sparganium emersum*, found within the deeper waters of 0.75 – 2.35 m. *Fontinalis antipyretica* was only recorded in S3 between 0.25 – 2.35 m. While *Elodea canadensis* was recorded as 'abundant' in 1988, it was only observed with rare abundance across all survey sections, in depths of 0.5 – >0.75 m. *Potamogeton natans* was recorded as 'dominant' in 1988, but was only seen on the strandline of S2 and S3 on the 2014 survey. Overall, there was good evidence for characteristic vegetation zonation. A full species list is given in Table 285 below.

Water quality

Round Lough is a shallow (Z_{max} recorded = 6.7 m), eutrophic lake with a moderate annual mean TP (37.6 μgl^{-1}) for a lough of its type, which classifies it as "favourable" for trophic status. This assessment is based on the assumption (informed by observations) that the average depth of the lough is less than 3.0 m (JNCC 2015). The mean annual chlorophyll *a* concentration is just outside the acceptable range for the lake type (5.8 μgl^{-1} has been suggested as the upper limit for the high good boundary for Chl *a* in HA Sh lakes (Carvalho, 2006)). More regular monitoring of Chl *a* is however required to provide an accurate assessment (WFD UKTAG 2014). At the time of survey in June 2014, the upper 2 m of the water column was well oxygenated (5.7 – 7.5 mgl^{-1}). Mean DO below the thermocline (below 3m) was 0.33 1 mgl^{-1} (Figure 59). No surface algal blooms were present, although the water was slightly turbid and Secchi depth only 1.7 m.

Table 283 Water chemistry data for Round Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1988
TP	35.30	43.40	36.10	35.40	**37.6**	46
SRP	6.7	1.2	8.6	17.9	**8.6**	2
TN	0.82	0.87	0.95	1.36	**1.00**	0.81
TON	0.077	<0.005	0.139	0.637	**0.215**	-
Nitrite	0.004	0.004	0.005	<0.001	**<0.004**	-
Chl a	7.81	8.8	4.62	2.71	**5.99**	37.4
DOC	10.30	11.10	9.65	9.74	**10.20**	-
pH	7.89	7.89	7.87	7.89	**7.88**	7.69
Alk	133	135	129	127	**131**	78.5
Cond	325	321	324	322	**323**	326
Ca^{2+}	55.50	55.20	54.20	51.00	**53.98**	54.2
Mg^{2+}	2.72	2.80	2.93	2.69	**2.79**	2.65
Na^{+}	15.80	13.50	13.20	17.50	**15.00**	10
K^{+}	1.71	1.65	2.02	1.97	**1.84**	0.35
Cl^{-}	28.00	22.50	22.70	32.20	**26.35**	21.2
SO_4^{2-}	<10	9.25	10.00	9.83	**9.77**	6.5

Hydrology

Round Lough is upstream of Lough Fadda, and linked via a small outflow on the south-eastern shore. A succession of small streams eventually connects to the River Blackwater, which flows northeast into Lough Neagh. The hydrological regime at the site appears natural.

Lake substrate

The lake substrate is predominantly silty with peat and organic silts in the margins. In the shallower water areas of sections 2 and 3 along the northern shore, areas of root mass predominate at water depths of between 25 cm and 75 cm.

Sediment load

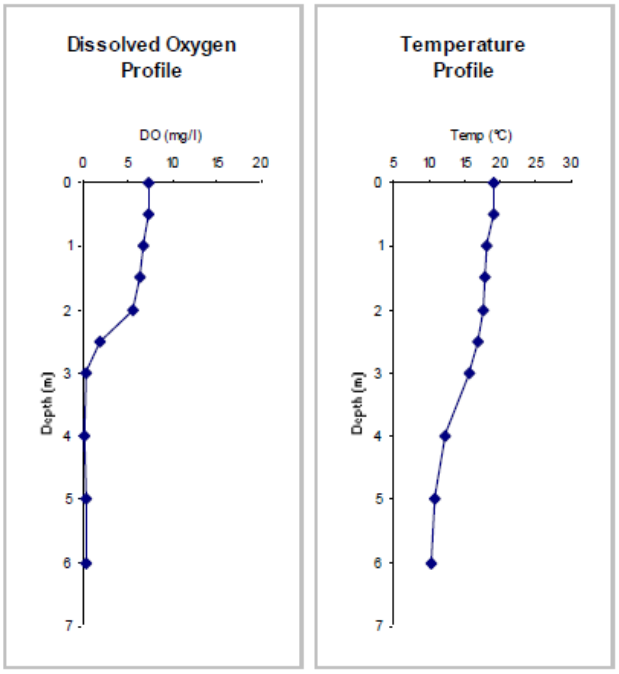
Round Lough is surrounded by gently sloping improved grassland, where grazing was observed to the south. However, no poaching was observed during the survey and there was no evidence for an increase in sediment load to the lough.

Figure 59 Dissolved oxygen and temperature profile for Round Lough (28/06/2014)

Dissolved Oxygen Profile

GPS Location	H4426148433
Maximum Depth (m)	6.7 m
Secchi Depth (cm)	1.7 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	7.47	19.1
0.5	7.3	19
1	6.86	18.1
1.5	6.47	17.9
2	5.63	17.6
2.5	1.88	17
3	0.35	15.7
4	0.27	12.3
5	0.32	10.8
6	0.41	10.3



Indicators of local distinctiveness

None noted.

Summary

Round Lough supports a moderate diversity of submerged and floating leaved flora, and clearly supports a well defined hydrosere. Only one characteristic species was recorded during the survey (*Potamogeton praelongus)*. The frequency of this species was below guideline levels (JNCC 2015). *Lemna trisulca* frequented a large proportion of the survey plots. A comparison of the 1988 and 2014 survey data suggests that since 1988 *Potamogeton crispus* and charophytes have become scarcer or may have been lost. The frequency of *E. canadensis* appears to have significantly decreased since 1988, downgraded from 'abundant' to currently 'rare'. The presence of any high priority non-native species is however unfavourable, even if at current levels its impact is minimal.. According to the TP data, the lough is only moderately enriched for its lough type and has appeared to have improved in trophic status since 1988. However the 1988 water chemistry data is based only on a summer spot-sample and direct comparison with the 2014 data should be treated with caution. Overall, due to the lack of characteristic species, Round Lough is considered to be in an **unfavourable** condition. The water chemistry is favourable however so Round Lough has the capacity to meet favourable status if additional characteristic species are found at the

site. Further investigation is recommended to better assess the status of *Potamogeton crispus* and charophytes within the lough.

Table 284 Round Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Round Lough NI Lake 835	**Unfavourable**	Only one characteristic species present at low abundance. *E. canadensis* present. Possible loss of characteristic species	Possible characteristic species loss since 1988 – including *Potamogeton crispus.* Favourable trophic status despite being surrounded by improved grassland. Sensitive to nutrient enrichment therefore it is recommended that potential sources of nutrients should be monitored.

Species list

Table 285 List of all plant species recorded at Round Lough.

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	A
Schoenoplectus lacustris	F
Sparganium emersum	F
Equisetum fluviatile	F
Carex rostrata	F
Galium palustre	F
Cladium mariscus	O
Potentilla palustris	O
Cicuta virosa	O
Alnus glutinosa	O
Mosses unid	O
Carex disticha	R
Salix sp.	R
Juncus acutiflorus	R
Potamogeton alpinus	R
Carex paniculata	R
Filipendula ulmaria	R
Caltha palustris	R
Mentha aquatica	R
Myosotis scorpioides	R
Ranunculus flammula	R
Epilobium parviflorum	R
Angelica sylvestris	R
Epilobium palustre	R
Typha latifolia	R
Alisma plantago-aquatica	R
Veronica scutellata	R
Cardamine pratensis	R
Stellaria palustris	R
Lychnis flos-cuculi	R
Epilobium hirsutum	R
Potentilla anserina	R
Submerged & floating species	**% Frequency (n = 74)**
Elodea canadensis	23
Fontinalis antipyretica	9
Lemna minor	1
Lemna trisulca	53
Menyanthes trifoliata	18
Nuphar lutea	73
Nymphaea alba	12
Potamogeton alpinus	10
Potamogeton praelongus	19
Sparganium emersum	30
Potamogeton natans	+

Survey data

Site Condition Assessment: Round Lough (28/06/2014)

Lake Details		Survey Details		
Lake Name	Round Lough	Survey Date	28/06/2014	
SSSI Name		Surveyors	BG, SG	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H443484	Wader Surveys	3	3
WBID / NI No.	50353 / 835	Boat Surveys	3	sections

Site Survey

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	250 cm
		Compass bearing of boat transect (°)	200 °
		Lateral distance from waters edge to 75cm depth (m)	7 m
		Notes: BG Camera	
Section	**2**	Maximum depth of colonisation (cm)	240 cm
		Compass bearing of boat transect (°)	285 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Short boat survey transect - ~10m	
Section	**3**	Maximum depth of colonisation (cm)	240 cm
		Compass bearing of boat transect (°)	35 °
		Lateral distance from waters edge to 75cm depth (m)	12 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H4437948324	H4427948335	H4432548319	H4431448358
Section	**2**	H4419048411	H4420348502	H4417848459	H4419148458
Section	**3**	H4431148504	H4438448452	H4436248493	H4435748472

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	2439	2440	2441
Section	**2**	2442	2443	2447
Section	**3**	2448	2449	2450

3.56. Fadda Lough (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	28 June 2014
NI Lake Number:	836
WBID:	50304
County:	Tyrone
Grid reference:	H450484
OS Grid reference (X,Y):	244975,348441
Shoreline development index:	1.247
Surface area (ha.):	4
Maximum recorded depth (m):	5

Table 286 Condition Assessment Summary Table for Fadda Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	✓	6 characteristic species present in 2014: *P. alpinus*, *P. lucens, P. praelongus, P. crispus, Utricularia vulgaris* agg. *& Callitriche sp.*
	No loss of characteristic species	**X**	*Chara* spp. recorded as frequent in 1988 NILS survey. No records in 2014
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	66% of vegetated sample spots comply

Attribute	Target	Status	Comment
Negative indicator species	Negative indicator species absent or at a low frequency	✓	*Elodea canadensis* present, but at relatively low frequency
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 17.9% of submerged sample points.
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Small amount of filamentous algae recorded. <1%.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Lake surrounded by mixed woodland. Margins comprised of areas of reed fringe consisting of *P. australis* , *S. lacustris, T. latifolia and C. rostrata* interspersed with a *M. trifoliata* hydrosere. Beyond the hydrosere *H. vulgaris* and *U. vulgaris agg*. common followed by a lily fringe dominated by *N. lutea* and occasionally *N. alba*. Within the lily fringe *P. lucens, P. alpinus*, *P. praelongus, E. canadensis* and *S. emersum* grow. No submerged plants beyond the lily fringe.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 5 m; Z_s = 1.24 m; Z_v = > 2.77 m.
	At least the present structure should be maintained	-	No evidence of change
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	✓	TP = 37.2μgl^{-1} (30 – 44.9 μgl^{-1}) & TN = 0.98 mgl^{-1} (Apr'14 – Feb'15)
	Stable pH / ANC values: pH >7.00 & <9.00	✓	pH = 7.8 (range = 7.6 – 8.2)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	**X**	> 9.22 mgl^{-1} down to 2m depth. Average DO below the thermocline <5 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	✓	None noted
Hydrology	Natural hydrological regime	✓	Appears natural.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓?	Natural shoreline maintained. Macrophyte cutting on the northern shore near manor house.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	*P. lucens and P. praelongus* present. *C. virosa* common in the margins.
	Minimal negative impacts and no fish farming	✓?	Boat and shore fishing

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 4 ha, with no loss of extent of open water.

Macrophyte community composition

Fadda Lough has a good range of macrophyte taxa with this survey recording 15 species of submerged and floating leaved taxa. Six characteristic species were recorded including 4 broadleaved *Potamogeton spp.* (*P. alpinus*, *P. lucens, P. praelongus & P. crispus)* as well as *Callitriche sp* and *Utricularia vulgaris agg*. Other notable aquatic species included; *Hippuris vulgaris*, *Sagittaria sagittifolia* and *Nymphaea alba*. *Elodea canadensis* was present but nowhere did it dominate. There was a species rich margin where no one species dominated. A mixture *of Phragmites australis, Schoenoplectus lacustris, Carex rostrata, Equisetum fluviatile, Cicuta virosa, Menyanthes trifoliata, Sparganium erectum, Alisma plantago-aquatica, Typha latifolia* and other taxa grew in a species rich hydrosere around the lough. In total 38 macrophyte taxa were recorded in this survey.

The NI lake survey (NILS) recorded a very similar set of aquatic species at Fadda Lough as the current survey. Notable differences were the presence of *Potamogeton berchtoldii, Potamogeton natans* and *Chara hispida* in 1988 but absent in the current survey. *Sagittaria sagittifolia and Callitriche sp.* were recorded in the current survey but not in the NILS survey. These differences may represent a minor trophic shift or it could just reflect the different methodologies used in each survey, or inter annual variation. All other aquatic species were present in both surveys.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are similar to those calculated form the NILS 1988 data, suggesting that the tropic status is stable (Table 287).

Negative indicator species

Elodea canadensis was found at 17.9% frequency in the current survey, a frequency that is below the 50% level deemed acceptable under CSM guidance (JNCC 2015).

E. canadensis has been present in the lough at least since the NILS survey and appears that its presence is stable.

Table 287 Aquatic macrophyte community composition for Fadda Lough, including trophic scores

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=111)***
Callitriche sp.	**-**	**-**	**-**	**-**	**-**	**+**
Charophytes	**8.5**	**7.69**	**3**	**-**	**-**	**-**
Chara hispida	**8.5**	**7.69**	**+**	**-**	**-**	**-**
Elodea canadensis	8.5	7.95	5	8.5	7.95	17.9
Fontinalis antipyretica	6.3	5.38	3	6.3	5.38	2.4
Hippuris vulgaris	7.7	7.88	4	7.7	7.88	15.5
Lemna trisulca	10.0	8.85	2	10.0	8.85	11.9
Nuphar lutea	8.5	6.92	5	8.5	6.92	51.2
Nymphaea alba	6.7	3.08	2	6.7	3.08	3.6
Potamogeton alpinus	**5.5**	**5.38**	**4**	**5.5**	**5.38**	**7.1**
Potamogeton berchtoldii	7.3	7.69	2	-	-	-
Potamogeton crispus	**8.5**	**7.95**	**3**	**8.5**	**7.95**	**+**
Potamogeton lucens	**10.0**	**7.88**	**4**	**10.0**	**7.88**	**21.4**
Potamogeton natans	6.7	4.23	-	-	-	-
Potamogeton praelongus	**7.3**	**5.38**	**4**	**7.3**	**5.38**	**16.7**
Sagittaria sagitifolia	-	-	-	-	-	+
Sparganium emersum	10.0	7.50	3	10.0	7.50	23.8
Utricularia vulgaris agg.	**5.5**	**4.23**	**4**	**5.5**	**4.23**	**53.6**
Average score	**7.8**	**6.61**		**7.9**	**6.51**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Macrophyte community structure

Fadda lough is surrounded by mixed woodland apart from the northern shore which is bordered by a large manicured lawn. Marginal vegetation is apparently cut on this shore, although the majority of the shoreline is unmanaged. The lough is bordered by reeds beds that comprise; *S. lacustris, P. australis*, *T. latifolia*, *C. rostrata* and *S. erectum* as well as a floating hydrosere dominated by *M. trifoliata interspersed with* other marginal species. Beyond the reed fringe there is a clear lily zone which is dominated by *N. lutea* with occasional *N. alba*. Growing amongst the lily zone are various submerged species such as *P. lucens, P. praelongus, P. alpinus, H. vulgaris, U. vulgaris agg* and *E. canadensis.* No submerged plants grow beyond the outer extent of the water lilies at 2.4-2.7 m depth.

Water quality

Fadda Lough is a shallow (Z_{max} recorded = 5 m), eutrophic lake with an annual mean TP (37.2 μgl^{-1}) which is within the guideline levels for this type of lake (JNCC 2015) and is therefore "favourable" with respect to trophic status. Small amounts of filamentous algae were recorded and no algal blooms were present. The mean Chlorophyll *a* level is moderate but one high reading in November 2014 is notable. Excessive phytoplankton growth in this season is unexpected and may be a response to higher TP concentrations, although this was not detected in the water chemistry data. The upper 2.0 m of the water column was well oxygenated (> 9.0 mgl^{-1}), dropping to less than 3.5 mgl^{-1} below 3.0 m (Figure 60) and therefore doesn't meet current guidance (JNCC 2015)

Table 288 Water chemistry data for Fadda Lough

	Apr '14	Aug '14	Nov '14	Feb '15	Mean	1988
TP	30.3	44.9	43.4	30.0	**37.2**	29
SRP	2.4	12.1	6.5	12.3	**8.3**	2
TN	0.77	0.8	0.9	1.46	**0.98**	0.63
TON	0.104	0.030	0.034	0.86	**0.257**	n/a
Nitrite	0.005	0.004	0.003	0.003	**0.004**	n/a
Chl *a*	7.90	2.06	51.26	3.40	**16.2**	27.1
DOC	8.3	10.3	7.53	8.93	**8.77**	n/a
pH	8.17	7.55	7.82	7.83	**7.84**	7.62
Alk	188	157	180	169	**174**	108
Cond	440	349	418	416	**406**	436
Ca^{2+}	78.7	62	73	68.3	**70.5**	73.4
Mg^{2+}	3.61	2.99	3.82	3.24	**3.42**	3.55
Na^{+}	19.2	13.2	16.5	23.8	**18.2**	13.3
K^{+}	1.77	1.47	1.82	1.96	**1.76**	0.25
Cl^{-}	34.2	21.8	29.6	40	**31.4**	26.5
SO_4^{2-}	10.7	8.5	7.63	11.1	**9.48**	8.2

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty.

Sediment load

The dominant land cover in the catchment is rough pasture and mixed woodlands, although on the north side of the lough managed gardens are present. Disturbance appears to be relatively low around most of the lough and the sediment load appears natural throughout the majority of the lough.

Indicators of local distinctiveness

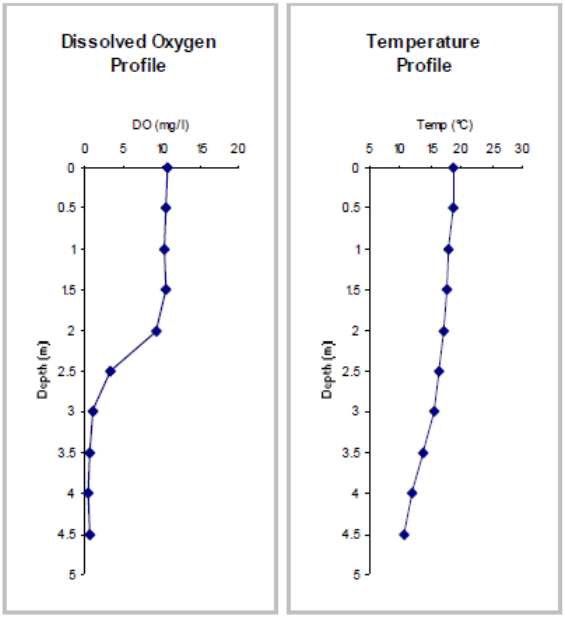
Potamogeton lucens and *Potamogeton praelongus* are frequent in the lough. These species will often disappear under hyper-eutrophic conditions.

Figure 60 Dissolved oxygen and temperature profile for Fadda Lough (28/06/2014)

Dissolved Oxygen Profile

GPS Location	H4499048474
Maximum Depth (m)	5 m
Secchi Depth (cm)	124 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	10.8	18.7
0.5	10.45	18.6
1	10.28	17.9
1.5	10.45	17.6
2	9.22	17.2
2.5	3.36	16.4
3	1.11	15.5
3.5	0.68	13.8
4	0.48	11.9
4.5	0.54	10.7



Summary

Fadda lough is a good example of a eutrophic lake within a lowland agricultural landscape. The aquatic flora of the lough is diverse and characteristic for a eutrophic lake containing 4 characteristic *Potamogeton* species and 2 other characteristic submerged macrophytes. No one taxa dominates particularly in the margins where a mixture of reed beds and hydrosere create a diverse assemblage. Lilly growth is abundant but is sparse enough to allow other submerged taxa to grow amongst them such as *P. lucens* and *P. praelongus*. TP levels were within the guideline levels set for this lake type (JNCC 2015) but the autumn chlorophyll a reading was high so there are signs of increasing eutrophication. The taxa list from the NILS 1988 survey is very similar to the current survey so the macrophyte community appears stable. *E. canadensis* has been present at the site at least since the NILS survey and also appears to be stable. Nowhere does it dominate and no detrimental impact on native taxa is apparent.

Given the above evidence Fadda Lough is classed as **Favourable, at risk**.

Table 289 Fadda Lough: Overview

Water Body	Status	Reason(s) for at risk	Comments
Fadda Lough NI Lake 836	**Favourable, at risk**	High chlorophyll *a* reading in autumn, but	The macrophyte community appears

	macrophyte community appears stable.	stable, characteristic and diverse

Species list

Table 290 List of all plant species recorded at Fadda Lough

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Alnus glutinosa	O
Angelica sylvestris	R
Caltha palustris	R
Cardamine pratensis	R
Carex paniculata	R
Carex rostrata	O
Carex sp.	R
Cicuta virosa	R
Equisetum fluviatile	F
Equisetum palustre	R
Galium palustre	R
Iris pseudacorus	R
Juncus acutiflorus	R
Mentha aquatica	O
Menyanthes trifoliata	F
Phalaris arundinacea	R
Phragmites australis	F
Potentilla palustris	R
Salix sp.	R
Schoenoplectus lacustris	R
Solanum dulcamara	R
Sparganium erectum	R
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 111)**
Callitriche sp.	+
Elodea canadensis	17.9
Fontinalis antipyretica	2.4
Hippuris vulgaris	15.5
Lemna trisulca	11.9
Nuphar lutea	51.2
Nymphaea alba	3.6
Potamogeton alpinus	7.1
Potamogeton crispus	+
Potamogeton lucens	21.4
Potamogeton praelongus	16.7
Sagittaria sagitifolia	+
Sparganium emersum	23.8
Utricularia vulgaris agg.	53.6

Survey data

Site Condition Assessment: Fadda Lough (28/06/2014)

Lake Details		**Survey Details**		
Lake Name	Fadda Lough	Survey Date	28/06/2014	
SSSI Name		Surveyors	SD & AH	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H450484	Wader Surveys	3	3
WBID / NI No.	50304 / 836	Boat Surveys	3	sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	240 cm
		Compass bearing of boat transect (°)	249 °
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	277 cm
		Compass bearing of boat transect (°)	191 °
		Lateral distance from waters edge to 75cm depth (m)	2 m
		Notes:	
Section	**3**	Maximum depth of colonisation (cm)	250 cm
		Compass bearing of boat transect (°)	109 °
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H4483148379	H4480948457	H4480848413	H4482748418
Section	**2**	H4490248396	H4499548411	H4496248414	H4496048420
Section	**3**	H4510348508	H4508648413	H4509148451	H4507648449

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0003	0004	0006
Section	**2**	0007	0008	-
Section	**3**	0013	0012	0011

3.57. Mill Lough 885 (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	07 July 2014
NI Lake Number:	885
WBID:	50030
County:	Fermanagh
Grid reference:	H247386
OS Grid reference (X,Y):	224661,338550
Shoreline development index:	1.70
Surface area (ha.):	34.4
Maximum recorded depth (m):	9.3

Table 291 Condition Assessment Summary Table for Mill Lough (885)

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	✓	13 present: *P. gramineus, P. filiformis, P. lucens, P. perfoliatus, P. praelongus, P. x nitens, P. x angustifolius, R. circinatus, Chara virgata, C. curta, C. contraria, C. globularis* & *L. uniflora.* Inclusive of 6 broad-leaved pondweeds.
	No loss of characteristic species	✓?	*Chara rudis* recorded in 2006 but not in 2014

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	74% of vegetated sample spots comply
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* recorded at 68% of submerged sample points
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 68% of submerged sample points. No other non-natives recorded
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	5 sample spots have scores of 3, but overall cover was < 20%
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Varied, but species rich emergent zones (*P. australis, S. lacustris, C. rostrata, E. palustris, I. pseudacorus, A. plantago-aquatica, B. ranunculoides*). Extensive submerged beds of *Potamogeton* spp. / *Chara* spp. / *L trisulca* to 1.5-2.2 m . *E. canadensis* to 3.8 m
	Maximum depth distribution should be maintained	✓	Z_{max} = 9.3 m, Z_s = 2.90 m, Z_v = 4 m
	At least the present structure should be maintained	**✓?**	Hydrosere present – no change evident
Water quality	Stable nutrients levels: TP target / limit = 35 µgl^{-1}	✓	TP = 24 µgl^{-1} & TN = 0.68 mgl^{-1} (Apr '14 – Feb'15)
	Stable pH values: pH ~ 7.0 – 9.0	✓	pH = 8.1 (range = 7.69 – 8.3)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	**X**	Waters were well oxygenated to c. 6.0 m (>6.0 mgl^{-1}), below which levels dropped off to < 1.0 mgl^{-1}. Mean DO below the thermocline was <5 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	**✓?**	Slight cyanobacterial bloom present during sampling. No marginal scums forming.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained, with slight disturbance from cattle poaching and shore angling
	Natural and characteristic substrate maintained	✓	No evidence of change
Sediment load	Natural sediment load maintained	✓	Minor disturbance of shoreline by cattle poaching, but no evidence of significantly increased sediment loads

Attribute	Target	Status	Comment
Indicators of local distinctiveness	Distinctive elements maintained	✓?	None specified – *Chara curta* is listed as a priority species for NI.
	Minimal negative impacts and no fish farming	✓	Moderate grazing pressure from cattle and slight poaching. Site used for both shore and boat angling

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 34.4 ha, with no loss of extent of open water.

Macrophyte community composition

Mill Lough has an exceptional aquatic macrophyte assemblage with respect to the characteristic species as well as a rich marginal and emergent flora. The lough supports thirteen of the *Magnopotamion* and *Hydrocharition*-type species and 22 submerged and floating species in total. The occurrence of 9 different *Potamogeton* taxa in a water body of this size is extremely rare and coupled with the rarity of *Littorella uniflora* in this lake type means it cannot easily be fitted into any of the major lake types identified by Duigan *et al.* (2006) for British lake communities.

The dominant taxa present are very similar to when the lough was last surveyed in 2006. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site have both increased since 2006. Although caution is needed when interpreting these scores the increase indicates a possible trophic shift at the site due to the presence of *Ranunculus circinatus*, *Potamogeton pectinatus and Myriophyllum spicatum* all of which were absent in 2006. One characteristic taxa recorded in the 2006 survey, was not seen in 2014: *Chara rudis.* This species was only recorded at one point in 2006 so was present in low abundance. It is possible that the species is still present but was not recorded. Two characteristic taxa were recorded in 2014 but not in 2006; *Chara globularis* and *R. circinatus*. Like *C. rudis* in 2006, *C. globularis* was only recorded in one plot so it is also possible that it was present but not recorded in 2006. *R. circinatus* on the other hand was present in 20% of all plots in 2014. *Littorella uniflora* was not recorded in the 2006 survey although it was known to be present at the site; it was however recorded in the survey sections in the 2014 survey. *P. pectinatus* and *M. spicatum* were recorded new to the site in 2014. Although only found in one plot, the presence of *P. pectinatus* can indicate increased eutrophication and possible deterioration of the site. Its presence, alongside the two other newly recorded taxa *R .circinatus* and *M. spicatum* therefore should be carefully monitored in the future as it may represent the beginnings of a trophic shift, although currently the dominant characteristic taxa remain stable.

Table 292 Aquatic macrophyte community composition for Mill Lough, including trophic scores

Submerged and floating vegetation	2006			2014		
	TRS	PLEX	% occurrence (n=97)*	TRS	PLEX	% occurrence (151)
Chara contraria	**8.5**	**7.69**	**16**	**8.5**	**7.69**	**27.8**
Chara curta	**8.5**	**7.69**	**12**	**8.5**	**7.69**	**4**
Chara rudis	**8.5**	**7.69**	**1**	**-**	**-**	**-**
Chara virgata	**8.5**	**7.69**	**48**	**8.5**	**7.69**	**37.1**
Chara globularis	**-**	**-**	**-**	**8.5**	**7.69**	**0.7**
Elodea canadensis	8.5	7.95	71	8.5	7.95	68.2
Fontinalis antipyretica	6.3	5.38	38	6.3	5.38	18.5
Lemna minor	9.0	8.85	2	9.0	8.85	6.6
Lemna trisulca	10.0	8.85	76	10.0	8.85	46.4
Littorella uniflora	**6.7**	**4.23**	**+**	**6.7**	**4.23**	**6**
Myriophyllum spicatum	-	-	-	10.0	8.85	4.6
Nitella flexilis agg.	5.5	5.58	3	5.5	5.58	1.3
Nuphar lutea	8.5	6.92	4	8.5	6.92	7.9
Nymphaea alba	6.7	3.08	+	-	-	-
Potamogeton berchtoldii	7.3	7.69	14	7.3	7.69	12.6
Potamogeton filiformis	**10.0**	**7.69**	**4**	**10.0**	**7.69**	**5.3**
Potamogeton gramineus	**7.3**	**7.31**	**6**	**7.3**	**7.31**	**14.6**
Potamogeton lucens	**10.0**	**7.88**	**3**	**10.0**	**7.88**	**5.3**
Potamogeton perfoliatus	**7.3**	**7.69**	**13**	**7.3**	**7.69**	**+**
Potamogeton praelongus	**7.3**	**5.38**	**7**	**7.3**	**5.38**	**2.0**
Potamogeton x nitens		**7.69**	**2**		**7.69**	**+**
Potamogeton x angustifolius		**7.69**	**7**		**7.69**	**4.6**
Potamogeton pectinatus	-	-	-	10.0	8.85	0.7
Ranunculus circinatus	**-**	**-**	**-**	**10.0**	**8.85**	**20.5**
Average score	**8.0**	**7.00**		**8.2**	**7.30**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was abundant throughout the site and was recorded in 68% of all submerged sample points. *E. canadensis* was also recorded as abundant in 1988 ("4" on a 1-5 scale) and in 2006 (71%) and therefore it is unlikely there has been any significant change in this species over the past 26 years. Although this is unfavourable, Mill Lough is however rather unique in that it has supported a very rich submerged flora despite the long-term presence of *E. canadensis,* making an overall condition assessment of "unfavourable" seem somewhat unjustified. Furthermore, although *E. canadensis* was found to occur in 68% of sample plots, it was mostly recorded at low cover scores in shallower water (<1.5 m), only becoming abundant in deep water (1.5-3.0 m). The deep water *Potamogeton* species (e.g. *P. berchtoldii* and *P. praelongus*) were also found in abundance growing through dense beds of *E.*

canadensis, the different growth forms giving a degree of spatial separation in the water column. Due to the otherwise excellent quality of the aquatic flora, in this particular case it is considered by the author that the site is favourable with respect to the macrophyte community, but is “at risk” of loosing favourable status if any further evidence of species loss or shift towards negative species is observed. No zebra mussels were recorded at the site.

Macrophyte community structure

Mill Lough is surrounded by a number of different transitional vegetation zones from open water through to wet woodland on the northwest shore, fen meadow on the eastern shores and dense *Scirpo-Phragmitetum* communities around the southeast margin. The *Phragmites australis* and *Schoenoplectus lacustris* beds extended lake-wards to approximately 1.1 m water depth. Notable shore species included *Ranunculus lingua* and *Baldellia ranunculoides* which are both relatively scarce in Northern Ireland. The submerged flora also shows distinct zonation with areas of *Chara* spp., *P. filiformis* and *P gramineus* in shallow water, other *Potamogeton* species in deeper water (75-200cm) mixed with *L. trisulca, Fontinalis antipyretica* and *E. canadensis*, the latter extending to a maximum depth of 3.7 m. A full species list is given in Table 300 below

Water quality

Table 293 Water chemistry data for Mill Lough

	Apr ’14	Aug '14	Nov '14	Feb ’15	Mean	2006	1988
TP	17.6	32.1	29.0	18.2	**24.2**	23.0	48.0
SRP	1.6	<1.0	9.9	1.7	**<3.6**	n/a	n/a
TN	0.49	0.74	0.85	0.64	**0.68**	0.47	1.07
TON	<0.005	<0.005	0.074	0.144	**<0.057**	n/a	n/a
Nitrite	<0.001	<0.001	0.006	0.002	**<0.003**	n/a	n/a
Chl a	3.74	6.76	10.45	8.69	**7.41**	11.10	40.60
DOC	4.69	5.38	5.55	4.90	**5.13**	n/a	n/a
pH	8.16	8.12	7.91	8.25	**8.09**	7.80	7.40
Alk	92.0	71.0	86.0	95.0	**86.0**	107.8	n/a
Cond	216	175	205	227	**206**	226	248
Ca^{2+}	35.0	26.1	33.8	38.9	**33.5**	40.8	34.0
Mg^{2+}	2.75	2.73	2.76	2.77	**2.75**	2.50	3.30
Na^{+}	7.36	7.63	7.58	8.32	**7.72**	7.20	8.70
K^{+}	1.09	1.39	1.89	1.35	**1.43**	3.70	0.3
Cl^{-}	12.7	11.8	15.2	25.8	**16.4**	11.40	19.4
$SO4^{2-}$	<10	5.36	4.96	6.54	**<6.72**	13.20	6.40

Mill Lough is a relatively shallow (Z_{max} = 9.3 m), high alkalinity lake with relatively low annual mean TP which classifies it as “favourable” with respect to trophic status. Other water quality parameters are consistent with the lake type (i.e. HA VSh). Previous water quality data taken in 1988 indicates that TP, Chl *a* and TN have been

higher in the past (48 μgl^{-1}, 41 μgl^{-1} & 1.07 mgl^{-1} respectively), and although no firm conclusions can be drawn from these two sets of independent data, it is encouraging to note that nutrient concentrations and algal biomass have not increased over the past 26 years.

Despite a slight cyanobacterial bloom being present during the survey, water clarity was otherwise good (Secchi depth = 290 cm) and the mean annual chlorophyll *a* concentration was acceptable (15 μgl^{-1} has been suggested as the upper limit for Chl *a* in HA VSh lakes (Wilby *et al.* 2006)). The upper 5 m of the water column was well oxygenated declining to almost zero at the deepest point (Figure 61).

Hydrology

Mill Lough drains to the north into the main R. Erne channel via a short outflow stream. The hydrological regime at the site appears natural.

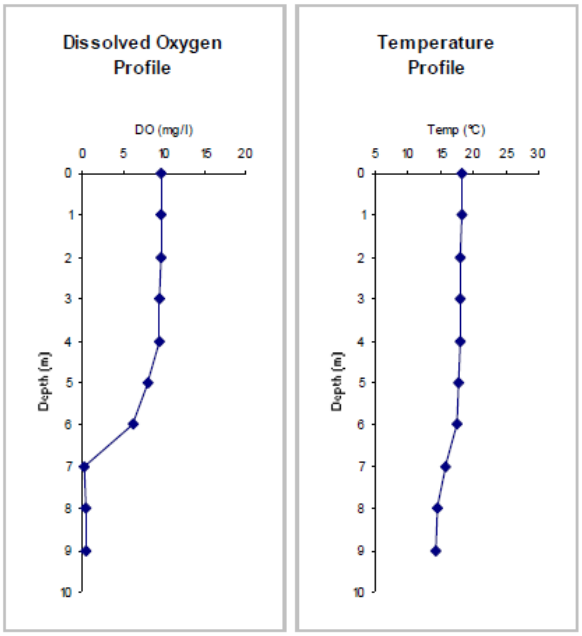
Lake substrate

The lake substrate is predominantly silty, with areas of cobbles and boulders along the south and east shores.

Figure 61 Dissolved oxygen and temperature profile for Mill Lough (07/07/2014)

GPS Location	H2457938514
Maximum Depth (m)	9.3 m
Secchi Depth (cm)	290 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	9.58	18.3
1	9.56	18.2
2	9.55	18.1
3	9.44	18.1
4	9.35	17.9
5	7.98	17.7
6	6.22	17.4
7	0.29	15.7
8	0.31	14.5
9	0.37	14.2



Sediment load

Areas along the south shore have been exposed to livestock grazing and poaching, but with no evidence of increased sediment loading to the lough. No further evidence of increased sediment load was noted from the catchment.

Indicators of local distinctiveness

Mill Lough is of particular importance due to its diverse aquatic flora and particularly its 9 different *Potamogeton* species, of which *P. filiformis* and *P. praelongus* are relatively uncommon. The lough is also important for the stonewort, *Chara rudis*

which is listed as “near threatened” (Stewart, 2004), although this species was not detected in the 2014 survey.

Summary

Mill Lough has an exceptional aquatic flora and supports a rich and varied emergent and marginal macrophyte assemblage. A total of 13 characteristic species were recorded and 74% of the aquatic sample plots (n = 151) had at least one characteristic species present. While the abundance of *Elodea canadensis* is clearly of considerable concern, it appears to have been present in the site at similar levels for at least 26 years without the loss of any deep-water plant species. Despite the presence of *E. canadensis* the exceptional quality of the aquatic flora and apparent stability of the site is enough for it to be considered in **favourable condition**, but it is placed in an “**at risk**” category. It is recommended that Mill Lough is monitored annually (both water quality and aquatic macrophytes) and the condition reassessed as unfavourable subject to any evidence of either an increase in *E. canadensis* or a decline in any other characteristic species.

The presence of 3 new species of submerged macrophyte (*P. pectinatus*, *M. spicatum* and *R. circinatus*) that can thrive in hyper eutrophic conditions is worth noting. *P. pectinatus* in particular can dominate a lake in hyper-eutrophic conditions, so although it is currently present in very low numbers its presence should be monitored in future.

Mill Lough is utilised as a trout fishery (DCAL), and is annually stocked with a total of c. 10000 rainbow (an alien species) and brown trout for catch and removal under permit from both boat and shore angling. The impacts of releasing of so many invertebrate feeders into a lake are poorly understood, but the likelihood of potential imbalance being caused on the trophic cascades within the system are high and it is recommended that stocking rates be re-evaluated. Furthermore, the deliberate release of any non-native species (i.e. rainbow trout) into an SAC/ASSI site should be discouraged. Angling also brings an increased risk of accidental alien introduction of plant species such as *Elodea nuttallii* and *Crassula helmsii* which although currently rare in Northern Ireland, if introduced these highly competitive species could have a major impact on the native plant communities of Mill Lough.

No evidence of direct nutrient inputs was observed, but a number of new properties have been built close to the west shore of Mill Lough and therefore pose a potential threat to the site if sewerage systems are not properly maintained.

Table 294 Mill Lough: Overview

Water Body	Status	Reason(s) for concern	Comments
Mill Lough NI Lake 885	Favourable (at risk)	Risk of *E. canadensis* out-competing aquatic taxa.	13 characteristic species present. Moderate TP levels. *E. canadensis* exceeds FCT targets, but appears to have been stable for over 25 years with no evidence of species loss. 3 new taxa recorded in 2014; *P. pectinatus*, *M. spicatum* and *R. circinatus* are possibly indicative of a shift towards increased eutrophic conditions but currently remain at very low frequency. Stocking of Rainbow trout inconsistent with the conservation status and angling increases the risk of non-native species introductions

Species list

Table 295 List of all plant species recorded at Mill Lough 2014

Marginal & Emergent species	Abundance (DAFOR)
Juncus inflexus	F
Phragmites australis	F
Schoenoplectus lacustris	F
Carex rostrata	F
Ranunculus circinatus	O
Iris pseudacorus	O
Filipendula ulmaria	O
Baldellia ranunculoides	R
Senecio aquaticus	R
Mentha aquatica	R
Myosotis scorpioides	R
Angelica sylvestris	R
Caltha palustris	R
Eleocharis palustris	R
Persicaria amphibia	R
Menyanthes trifoliata	R
Equisetum fluviatile	R
Carex remota	R
Apium nodiflorum	R
Juncus acutiflorus	R
Typha latifolia	R
Alisma plantago-aquatica	R
Nuphar lutea	R
Lysimachia vulgaris	R
Carex nigra	R
Prunella vulgaris	R
Hydrocotyle vulgaris	R
Epilobium hirsutum	R
Cirsium palustre	R
Lythrum salicaria	R
Carex hirta	R
Lycopus europaeus	R
Epilobium palustre	R
Epilobium parviflorum	R
Galium palustre	R
Persicaria maculosa	R
Juncus articulatus	R
Juncus effusus	R
Rorippa nasturtium-aquaticum	R
Montia fontana	R
Veronica beccabunga	R
Sparganium erectum	R
Carex demissa	R
Ranunculus lingua	R

Submerged & floating species	% Frequency (n = 151)
Chara contraria	28
Chara curta	4
Chara virgata	37
Chara globularis	1
Elodea canadensis	68
Fontinalis antipyretica	19
Lemna minor	7
Lemna trisulca	46
Littorella uniflora	6
Myriophyllum spicatum	5
Nitella flexilis agg.	1
Nuphar lutea	8
Potamogeton berchtoldii	13
Potamogeton filiformis	5
Potamogeton gramineus	15
Potamogeton lucens	5
Potamogeton perfoliatus	+
Potamogeton praelongus	2
Potamogeton x nitens	+
Potamogeton x angustifolius	5
Potamogeton pectinatus	1
Ranunculus circinatus	21

Survey data

Site Condition Assessment: Mill Lough (07/07/2014)

Lake Details		**Survey Details**		
Lake Name	Mill Lough	Survey Date	07/07/2014	
SSSI Name & BG		Surveyors	SD & AH	
SAC Name		Shore Surveys	4	out of
Grid Ref	H247386	Wader Surveys	4	4
WBID / NI No.	50030 / 885	Boat Surveys	4	sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	4 cm
		Compass bearing of boat transect (°)	165 °
		Lateral distance from waters edge to 75cm depth (m)	20 m
		Notes: big bed of p.lucens around fishing platform	
Section	**2**	Maximum depth of colonisation (cm)	340 cm
		Compass bearing of boat transect (°)	273 °
		Lateral distance from waters edge to 75cm depth (m)	12 m
		Notes:	
Section	**3**	Maximum depth of colonisation (cm)	380 cm
		Compass bearing of boat transect (°)	331 °
		Lateral distance from waters edge to 75cm depth (m)	12 m
		Notes:	
Section	**4**	Maximum depth of colonisation (cm)	320 cm
		Compass bearing of boat transect (°)	340 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H2473238760	H2468138689	H2471438721	H2472938659
Section	**2**	H2522238522	H2523538611	H2522938567	H2514438583
Section	**3**	H2463138223	H2456638163	H2460338177	H2456038247
Section	**4**	H2478038485	H2471138414	H2474438448	H2473138541

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	225	226	228
Section	**2**	225	226	228
Section	**3**	0229	0230	0231
Section	**4**	0219	0220	0221

3.58. Sessiagh East Lough (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	31 July 2014
NI Lake Number:	903
WBID:	50145
County:	Fermanagh
Grid reference:	H261345
OS Grid reference (X,Y):	226182,334606
Shoreline development index:	1.635
Surface area (ha.):	8.0
Maximum recorded depth (m):	1.0 m

Table 296 Condition Assessment Summary Table for Sessiagh East Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species from and 1 broad-leaved *Potamogeton* spp.	**X**	4 characteristic species present in 2014; *Hydrocharis morsus-ranae, Potamogeton obtusifolius, Ranunculus circinatus, Spirodela polyrhiza* (and *Stratiotes aloides*). But no submerged broad-leaved pondweeds recorded

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	The characteristics broad-leaved pondweed *P. perfoliatus* was recorded in 1988 but was not detected in 2006 or the current survey so is likely extinct from the site. *Lemna spp.* and *P. berchtoldii* no longer considered characteristic species in updated CSM guidance (JNCC 2015)
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	86% of vegetated sample spots comply
Negative indicator species	Negative indicator species absent or at a low frequency	**X**	*Elodea canadensis* recorded at 49.3% of submerged sample points. *E. nuttallii* recorded new to the site and present at 18.8% of submerged sample points. *Potamogeton pectinatus* not recorded but was present in 2006.
	Non-native species absent or present at low frequency	**X**	*E. canadensis* recorded at 49.3% of submerged sample points. *E. nuttallii* present at 18.8% of submerged sample points. No zebra mussels evident.
	Benthic and epiphytic filamentous algal cover <10%	✓	Small amount of filamentous algal cover observed (<1%)
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Species rich marginal habitat with mix of reed, herbs and wet woodland. Submerged and floating leaved vegetation is species rich and zoned to some extent. Lake margin fringed with *N. lutea*. *S. polyrhiza* and *H. morsus-ranae* common in shallows (25cm). *R. circinatus* & *P. natans* occasional in *S. lacustris* beds (0.50 – 0.75 m) with *P. obtusifolius* and *E. nuttallii* common in deeper water (0.75 - 1.0 m). *E. canadensis* common in shallower water (0.25 – 0.50m) Plants grow to maximum water depth.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 1.0 m, Z_s = 1.0m, Z_v = > 1.0m; Turbid

Attribute	Target	Status	Comment
	At least the present structure should be maintained	✓	No evidence of change
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	✓	TP = 32 μgl^{-1} (range = 22 - 49 μgl^{-1}) & TN = 0.9 mgl^{-1} (Apr'14 – Feb'14)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.51 (range = 7.38 – 7.76)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	✓	DO = 8.3 mgl^{-1} at surface. No thermocline, too shallow.
	No excessive growth of cyanobacteria or green algae	✓	No blooms present, although water slightly turbid
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	High occurrence of *Sium latifolium* (87%), a priority species for Northern Ireland.
	Minimal negative impacts and no fish farming	✓	Moderate grazing pressure from cattle and slight poaching.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 8.5 ha, with no loss of extent of open water.

Macrophyte community composition

Sessiagh East Lough supports four characteristic species (*Hydrocharis morsus-ranae, Potamogeton obtusifolius, Ranunculus circinatus* and *Spirodela polyrhiza*), but has no broad-leaved *Potamogeton* species present (*P. natans* is not classed as a characteristic eutrophic species) (Table 297). *Stratiotes aloides* was also present, but is not included as a characteristic here due to it being considered as outside of its natural range (Preston and Croft 1997, Forbes 2000). The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) remain similar to the 2006 scores, but show a slight increase from the scores calculated from the 1988 data (7.9 & 7.06 respectively) which suggests a gradual enrichment at the site.

Eleocharis acicularis and the characteristics broad-leaved pondweed species *P. perfoliatus* were not recorded in 2006 or 2014 but were present in 1988; the latter species being abundant ("4" on a 1-5 scale). Apart from *Potamogeton pectinatus* all other aquatic species recorded in 2006 were found in 2014. Five additional species were found in 2014; *Elodea nuttallii, Hydrocharis morsus-ranae, Fontinalis*

antipyretica, Ranunculus circinatus and Spirodela polyrhiza. It was noted in 2006 that the characteristic species assemblage appeared to have shifted to one dominated by Hydrochariton species when compared to the 1988 data. This trend appears to have continued over the past 8 years as two more species of this type have been recorded (*H. morus-ranae & S. polyrhiza*) with only one new Magnopotamion species (*R. circinatus*) and no characteristic broadleaved *Potamogeton spp*. The lough also has a rich marginal and emergent flora; forty seven different wetland macrophyte taxa were recorded in 2014.

Table 297 Aquatic macrophyte community composition for Sessiagh East Lough, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=96)***	**TRS**	**PLEX**	**% occurrence (n=69)**
Elodea canadensis	8.5	7.95	66	8.5	7.95	49.3
Elodea nuttallii	**-**	**-**	**-**	10.0	7.95	18.8
Fontinalis antipyretica	-	-	-	6.3	5.38	13.0
Hydrocharis morsus-ranae	**-**	**-**	**-**	**-**	**-**	**14.5**
Lemna minor	9.0	8.85	1	9.0	8.85	21.7
Lemna trisulca	10.0	8.85	13	10.0	8.85	94.2
Nitella flexilis agg.	5.5	5.38	2	5.5	5.38	13
Nuphar lutea	8.5	6.92	52	8.5	6.92	62.3
Potamogeton berchtoldii	7.3	7.69	8	7.3	7.69	5.8
Potamogeton natans	6.7	4.23	21	6.7	4.23	15.9
Potamogeton obtusifolius	**7.3**	**6.54**	**18**	**7.3**	**6.54**	**2.9**
Potamogeton pectinatus	10.0	8.85	1	**-**	**-**	**-**
Ranunculus circinatus	**-**	**-**	**-**	**10.0**	**8.85**	**29.0**
Sagittaria sagittifolia	-	-	11	-	-	47.8
Sparganium emersum	10.0	7.50	15	10.0	7.50	37.7
Spirodela polyrhiza	**-**	**-**	**-**	**-**	**-**	**7.2**
Stratiotes aloides	**-**	**-**	**2**	**-**	**-**	**56.5**
Average score	**8.3**	**7.28**		**8.1**	**7.17**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was recorded in 49.3% of all submerged sample sites, a reduction from the 2006 survey (66%), but is still considered as unfavourable under guidelines laid down within the favourable condition tables (JNCC 2015). *Elodea nuttallii* was recorded for the first time in 2014 in 18.8% of submerged sample sites which is also above CSM guidelines (JNCC 2015). *E. nuttallii* is known to out-compete *E. canadensis* (Simpson, 1990) which may happen at this site over time. *Potamogeton pectinatus* was observed for the first time in 2006 suggesting enriched conditions, however the species was not detected in the 2014 survey and if it is still present it will be in low densities and is not therefore of concern at present.

The sheer abundance of *Lemna trisulca* should be noted. The plant was present at nearly all sampling points and in some cases was smothering vegetation and substrates. Abundance on this scale can be attributed to excessive nutrients and is of detriment to the ecological and aesthetic value of the lake. No zebra mussels were recorded at this site, though they have been observed in a linked lough (NI Lake Number: 904) so Sessiagh East Lough is very likely to be at risk.

Macrophyte community structure

Sessiagh East Lough is largely bounded by rough pasture on the eastern side, although poaching of the lake shore is minimised by a narrow fringe of *Scirpo-Phragmitetum* communities dominated by *P. australis*. There is an area of wet woodland (*Salix* sp.) to the North-West with a rich wetland habitat bordering the western bank. This species rich emergent zone has an abundance of *P. australis, Carex sp., S. erectum, Potentilla palustris, Lythrum salicaria, E. fluviatile, R. lingua, Sium latifolium* and *Salix* sp. Submerged and floating leaved vegetation is species rich and zoned to some extent. Most of the lake margin is fringed with *N. lutea, H. morsus-ranae and S. polyrhiza* with *P. natans, and E. canadensis* common in *S. lacustris* beds (0.50 – 0.75 m). *P. obtusifolius, N. lutea, R. circinatus* and *E. nuttallii* are common in deeper water (0.50 - 1.0 m) with sparse growth of *Sagittaria sagittifolia* and *P. berchtoldii. S. aloides* is common throughout the site at all depths and *L. trisulca* is dominant throughout covering most substrates and vegetation. Plants were found growing to the maximum water depth of the lough (1.0 m). A full species list is given in Table 300 below.

Water quality

Sessiagh East Lough is a small, shallow (Z_{max} recorded = 1.0 m) lake with TP levels (32 μgl^{-1}) within the guideline levels to meet favourable status (JNCC 2015). The mean TP levels have also dropped since the last survey in 2006 (45 μgl^{-1}). The mean annual chlorophyll *a* concentration is also within the acceptable range for the lake type (23 μgl^{-1} has been suggested as the upper limit for Chl *a* in HA VSh lakes (Phillips 2006)). The water column appears to be well oxygenated as a single reading at the surface showed the DO to be 8.3 mgl^{1}.

Hydrology

Sessiagh East Lough lies at approximately the same altitude as Upper Lough Erne and is linked to the Lough, via NI Lake 904, by an outflow to the south. Water levels are therefore partly governed by the hydrology of ULE with periodic winter flooding caused by the increased water level maintained by the Rivers Agency at Portora (Enniskillen). There is no evidence that high winter water levels adversely affect the condition Sessiagh East Lough.

Lake Substrate

The lake substrate is predominantly silty but shallow water areas (< 0.25m) are comprised of reed bed root mass.

Sediment load

The eastern lake shore has been exposed to livestock grazing and poaching but there is no clear evidence of increased sediment loading to the lough from these sources. No further evidence of increased sediment load was noted from the

catchment. There has been a decline in broad-leaved *Potamogeton* species since 1988 though water quality remains within target limits.

Table 298 Water chemistry data for Sessiagh East Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	2006	1988
TP	48.6	22.2	32.8	26.3	**32.4**	45.0	36.0
SRP	6.9	<1.0	6.3	4.7	**<4.7**	n/a	n/a
TN	0.95	0.89	1.06	0.71	**0.90**	0.90	1.80
TON	<0.005	<0.005	0.017	<0.005	**<0.008**	n/a	n/a
Nitrite	<0.001	<0.001	<0.001	<0.001	**<0.001**	n/a	n/a
Chl *a*	5.50	1.26	3.96	8.14	**4.7**	7.90	13.00
DOC	11.20	10.2	12.4	8.35	**10.54**	n/a	n/a
pH	7.76	7.38	7.52	7.47	**7.51**	7.50	8.20
Alk	83	70	69	63	**71**	57	46
Cond	203	173	186	183	**186**	195	267
Ca^{2+}	30.6	26.2	28.5	25.5	**27.7**	30.2	36
Mg^{2+}	3.37	3.18	3.15	3.04	**3.19**	2.80	4.40
Na^{+}	8.09	7.44	7.64	10.2	**8.34**	7.10	6.20
K^{+}	2.50	0.714	1.46	2.43	**1.78**	1.60	0.20
Cl^{-}	15	12.8	13.9	19.2	**15.23**	10	20.1
SO_4^{2-}	<10	5.81	12.1	8.11	**<9.0**	12.8	20.3

Indicators of local distinctiveness

Sessiagh East Lough is noteworthy due to the high frequency of *Sium latifolium*, a priority species for Northern Ireland. A frequency of 87% was recorded in 2006 and it was again present at high frequency in 2014.

Summary

Although having a relatively good characteristic flora and favourable water quality, Sessiagh East Lough is nonetheless classified as being in **unfavourable condition.** The presence of both *E. canadensis* and *E. nuttallii* are cause for concern. *Elodea nuttallii* is a recent addition to the lake flora and represents deterioration in the ecology of the site. *E. nuttallii* has spread rapidly throughout the Lough Erne catchment in recent years where it can grow in dense mats posing problems for recreation and navigation as well as the ecology. Both *Elodea spp.* can out-compete native plants and *E. nuttallii* can grow more vigorously in deeper water compared to *E. canadensis* (Simpson 1990).

Despite the presence of both *Elodea* spp. the lake still has species rich emergent and marginal macrophytes and contains 5 characteristic species present in more than 60% of sample plots. However, the high abundance of both *Lemna spp*, is indicative of eutrophication. Such a dominance of *Lemna spp*. was not apparent in 2006 so clearly represents a shift in the ecological status of the lake. Also, there are

no submerged broad-leaved *Potamogeton* species in the site; *P. perfoliatus* seemingly having disappeared since the 1988 survey.

Furthermore, the long term trend for Sessiagh East Lough appears to be one favouring more eutrophic tolerant *Hydrochariton* species. Historically the lake has supported a population of *Potamogeton perfoliatus* which will only thrive in less eutrophic waters and its absence since the 1980's suggests a shift towards enrichment. The mean annual TP, TN and Chl *a* concentrations are within the target limit to be classed as 'favourable' (JNCC 2015) therefore the lake has the potential to improve if *Elodea spp* and *Lemna spp.* abundance reduce.

Although no zebra mussels were observed they are present within the neighbouring lough (NI Lake Number 904) and Upper Lough Erne, both of which are linked to Sessiagh East Lough and therefore they should be expected to present. No evidence of direct nutrient inputs were observed, though less intensive agriculture around the shore would be beneficial.

Table 299 Sessiagh East Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Sessiagh East Lough NI Lake 903	**Unfavourable**	Loss of characteristic species *P. perfoliatus* since the 1980's. High frequency of *E. canadensis* (49%) and *E. nuttallii* (19%). Dense matts of *Lemna trisulca* growing throughout the site, not apparent in 2006. No broad-leaved pondweeds	The lough maintains a reduced characteristic aquatic flora, and water quality is within CSM targets. The site does however exhibit signs of deterioration in the flora, particularly the loss of *P. perfoliatus* and recent occurrence of *E. nuttallii.* At risk from zebra mussel invasion. Nutrient inputs should remain low.

Species list

Table 300 List of all plant species recorded at Sessiagh East Lough 2014

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	F
Sparganium erectum	O
Carex rostrata	R
Ranunculus lingua	R
Typha latifolia	R
Salix sp.	R
Equisetum fluviatile	R
Cicuta virosa	R
Oenanthe fistulosa	R
Sium latifolium	R
Myosotis scorpioides	R
Potentilla palustris	R
Schoenoplectus lacustris	R
Juncus effusus	R
Iris pseudacorus	R
Lythrum salicaria	R
Lysimachia vulgaris	R
Angelica sylvestris	R
Filipendula ulmaria	R
Juncus acutiflorus	R
Lysimachia nummularia	R
Hydrocotyle vulgaris	R
Caltha palustris	R
Epilobium palustre	R
Carex paniculata	R
Lychnis flos-cuculi	R
Alisma plantago-aquatica	R
Mentha aquatica	R
Submerged & floating species	**% Frequency (n = 74)**
Butomus umbellatus	3
Elodea canadensis	49
Elodea nuttallii	19
Fontinalis antipyretica	13
Hydrocharis morsus-ranae	15
Lemna minor	22
Lemna trisulca	94
Nitella flexilis agg.	13
Nuphar lutea	62
Potamogeton berchtoldii	6
Potamogeton natans	16
Potamogeton obtusifolius	3
Ranunculus circinatus	29
Sagittaria sagittifolia	48
Sparganium emersum	38
Spirodela polyrhiza	7
Stratiotes aloides	57

Survey data

Site Condition Assessment: Sessiagh East (31/07/2014)

Lake Details		Survey Details	
Lake Name	Sessiagh East	Survey Date	31/07/2014
SSSI Name		Surveyors	SD & EW
SAC Name	Upper Lough Erne	Shore Surveys	3 out of
Grid Ref	H261345	Wader Surveys	3 3
WBID / NI No.	0 / 903	Boat Surveys	2 sections

Site Notes:

Survey Notes:
Short boat transects performed as no outer edge of plant growth.

Section Summaries

Section 1

Maximum depth of colonisation (cm)	-
Compass bearing of boat transect (°)	280 °
Lateral distance from waters edge to 75cm depth (m)	20 m

Notes: Short boat transect due to no outer limit found

Section 2

Maximum depth of colonisation (cm)	-
Compass bearing of boat transect (°)	60 °
Lateral distance from waters edge to 75cm depth (m)	8 m

Notes:

Section 3

Maximum depth of colonisation (cm)	-
Compass bearing of boat transect (°)	-
Lateral distance from waters edge to 75cm depth (m)	-

Notes: no boat survey performed

Section Locations

	Shore Survey GPS Co-ords start	Shore Survey GPS Co-ords end	Boat Survey GPS Co-ords start (shore)	Boat Survey GPS Co-ords end (lake)
Section 1	H2609334226	H2611534314	H2609634287	H2613034284
Section 2	H2640234775	H2641934843	H2643334817	H2637234816
Section 3	H2606934651	H2613134737	H2610434693	-

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0105	0106	0107
Section 2	0108	0109	0110
Section 3	0111	0112	0113

3.59. Lough Digh (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	28 July 2014
NI Lake Number:	909
WBID:	50170
County:	Fermanagh
Grid reference:	H324332
OS Grid reference (X,Y):	232372,333243
Shoreline development index:	1.228
Surface area (ha.):	9.0
Maximum recorded depth (m):	3.8

Table 301 Condition Assessment Summary Table for Lough Digh

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	**X**	5 characteristic species present in 2014: *Chara globularis, P. perfoliatus*, *P. obtusifolius*, *Spirodela polyrhiza* & *Utricularia vulgaris agg.*
	No loss of characteristic species	✓**?**	Change is CSM guidance (JNCC 2015) has reduced the number of characteristic species in Lough Digh from 6 in the 2006 survey to 5 in the current survey. However no actual loss of these taxa.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	60% of vegetated sample spots comply
Negative indicator species	Negative indicator species absent or at a low frequency	**X**	*Elodea nuttallii* has colonised the site since 2006 and is present in 72.9% of sample points. *Elodea canadensis* recorded at 2% of submerged sample points a reduction from 27% in 2006.
	Non-native species absent or present at low frequency	**X**	As above
	Filamentous algae (non-*Chara*) <20% of points scoring 3.	✓	Filamentous algae recorded but no points scoring 3.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Species rich emergent zone with *P. australis* dominating and interspersed with *S. lacustris*. Submerged and floating leaved vegetation species rich and zoned to some extent. *Nuphar lutea* fringes the lough (0.75 – 1.1 m) with *L. trisulca, P. obtusifolius* and *E. canadensis* growing up to and above 0.75 m. Open water largely devoid of vegetation, apart from several large patches of *P. pectinatus* and *P. perfoliatus*. Turbid beyond water depths of 1.4 m.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 3.8 m; Z_s = 1.47m; Z_v = > 1.5 m.
	At least the present structure should be maintained	✓	No change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 86 μgl^{-1} (68 - 111 μgl^{-1}) & TN = 1.57 mgl^{-1} (May'14 – Feb'15)
	Stable pH / ANC values: pH >7.00 & <9.00	✓	pH = 7.66 (range = 7.48 – 7.84)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	✓	> 7.33 mgl^{-1} up to 3.5m depth
	No excessive growth of cyanobacteria or green algae	✓	None recorded
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓?	The very rare *Lathyrus palustris* was recorded in both the 2006 and 1988 survey but not in the 2014 survey. Possibly missed?
	Minimal negative impacts and no fish farming	✓	Moderate grazing pressure from cattle. Site used for boat angling. No zebra mussels observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 9.0 ha, with no loss of extent of open water.

Macrophyte community composition

Lough Digh has a moderately diverse submerged and floating leaved aquatic macrophyte flora both overall (20 species) and with respect to the representation of characteristic species. In 2014, five characteristic species were recorded, including one broad-leaved *Potamogeton* species (*P. perfoliatus*) (Table 302). The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site show no significant changes between the 3 survey years (1988, 2006, 2014). *M. spicatum* was recorded in the 1988 but not the 2006 survey but was common in the 2014 survey. Other new additions to the flora were noted in 2014 such as *Ceratophyllum demersum, Potamogeton pusillus, Ranunculus aquatilis, Utricularia vulgaris agg.*, *Oenanthe aquatic* and *Elodea nuttallii. Ceratophyllum demersum* is relatively rare in Northern Ireland, but appears to be on the increase in Fermanagh, with number of new records reported since 2006 (Forbes & Northridge 2012). The lough has a good marginal and emergent flora including fifty-two different aquatic and wetland macrophyte taxa recorded in 2014 (Table 305). The rare Marsh Pea *Lathyrus palustris* is known to occur at the site (Goldsmith *et al.* 2008), but was not recorded in 2014; possibly an oversight, but it is recommended that populations of this species are checked and monitored at the site.

Negative indicator species

The 2006 survey recorded *Elodea canadensis* at a frequency of 27%. By 2014 this had dropped to only 2.9% and instead had been replaced with a high abundance (72.6%) of *Elodea nuttallii*. *Elodea nuttallii* has probably arrived from neighbouring Lough Erne where it has been present for a number of years, perhaps reaching Lough Digh via winter flooding or anglers. *Elodea nuttallii* is well known to out-compete *E. canadensis* when both species occur in a single system (Simpsons, 1990), which appears to be the case here. Despite its greater abundance it doesn't appear to have had any direct impacted on the native plant community of the lake as yet, although this may occur over time. Surprisingly, given their abundance throughout the Lough Erne catchment, Zebra mussels were not recorded at the site, although this does not confirm their absence.

Macrophyte community structure

Lough Digh is largely bounded with rough pasture and a small area of wet woodland to the East. The Lough has a species rich emergent zone dominated by *Phragmites*

australis and interspersed with *Schoenoplectus lacustris* beds. Other commonly encountered marginal and emergent species include: *Equisetum fluviatile, Juncus effusus, Lysimachia nummularia* and *Sparganium erectum*. The rare marsh pea *Lathyrus palustris* was recorded in 2006, found growing in the southeast corner of the Lough. *L. palustris* was not recorded in the 2014 survey, and although possibly overlooked, its presence or absence at the site should be monitored. In open water, *Nuphar lutea* fringes the lough (0.75 – 1.1 m) with *P. pusillus and P. obtusifolius* and growing between to 0.5 – 1.05 m. *E. nuttallii* is abundant at all vegetated depths. *Charophyte* beds dominate at depth between 0.75 – 1.45 m with the open water largely devoid of vegetation and turbid beyond water depths of 1.5 m, apart from several large patches of *P. pectinatus* and *P. perfoliatus*. A full species list is given in Table 305 below.

Table 302 Aquatic macrophyte community composition for Lough Digh, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=71)***	**TRS**	**PLEX**	**% occurrence (n=70)***
Ceratophyllum demersum	-	-	-	10.0	8.85	1.4
Chara globularis	**8.5**	**7.69**	**28**	**8.5**	**7.69**	**8.6**
Elodea canadensis	8.5	7.95	27	8.5	7.95	2.9
Elodea nuttallii	-	-	-	10.0	7.95	72.6
Fontinalis antipyretica	6.3	5.38	1	6.3	5.38	5.7
Lemna minor	9.0	8.85	+	9.0	8.85	34.3
Lemna trisulca	10.0	8.85	51	10.0	8.85	84.3
Myriophyllum spicatum	-	-	-	9.0	8.85	20
Nitella flexilis agg.	5.5	5.38	18	5.5	5.38	48.6
Nuphar lutea	8.5	6.92	30	8.5	6.92	30
Potamogeton berchtoldii	7.3	7.69	14	-	-	-
Potamogeton pusillus	-	-	-	8.5	7.95	1.4
Potamogeton obtusifolius	**7.3**	**6.54**	**17**	**7.3**	**6.54**	**18.6**
Potamogeton pectinatus	10.0	8.85	1	10.0	8.85	2.9
Potamogeton perfoliatus	**7.3**	**7.69**	**1**	**7.3**	**7.69**	**5.7**
Oenanthe aquatica	-	-	-	-	-	+
Ranunculus aquatilis	-	-	-	8.5	7.95	1.4
Sparganium emersum	10.0	7.50	31	10.0	7.50	25.7
Spirodela polyrhiza	**-**	**-**	**1**	**-**	**-**	**21.4**
Utricularia vulgaris agg.	**-**	**-**	**-**	**5.5**	**4.23**	**32.9**
Average score	**8.2**	**7.44**		**8.4**	**7.49**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Water quality

Lough Digh is a shallow (Z_{max} recorded = 3.8 m), eutrophic lake with high annual mean TP (86.0 μgl^{-1}) which classifies it as "unfavourable" with respect to trophic status. The TP concentration hasn't changed significantly from the 2006 round of sampling (82.0 μgl^{-1}). The mean annual chlorophyll *a* concentration falls under the acceptable upper limit suggested for 'good' status (23 μgl^{-1} has been suggested as the upper limit for Chl *a* in HA VSh lakes (Wilby et al, 2006)) and is lower than the 2006 figure. The water column was well oxygenated declining to 7.33 mgl^{-1} at 3.0 m. (Figure 62). The DO profile is very similar to the one recorded in 2006.

Table 303 Water chemistry data for Lough Digh

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	2006	1988
TP	67.7	82.0	111.0	81.5	**85.6**	82.0	48.0
SRP	37.3	25.3	26.3	37.5	**31.6**	n/a	n/a
TN	0.80	1.30	2.17	2.01	**1.57**	1.40	1.30
TON	<0.005	<0.005	0.200	0.790	**<0.251**	n/a	n/a
Nitrite	0.001	0.001	0.017	0.010	**0.007**	n/a	n/a
Chl *a*	7.04	2.48	2.53	12.98	**6.26**	10.20	18.50
DOC	8.37	14.70	12.40	12.90	**12.09**	n/a	n/a
pH	7.84	7.73	7.48	7.66	**7.66**	7.70	7.70
Alk	59.0	91.0	98.0	91.0	**84.8**	119.70	63.40
Cond	149	217	247	303	**229**	228	277
Ca^{2+}	17.80	7.42	38.20	38.20	**25.41**	37.90	44.60
Mg^{2+}	1.33	33.60	4.09	4.01	**10.76**	3.00	4.30
Na^{+}	2.58	3.73	8.38	9.38	**6.02**	7.10	7.60
K^{+}	1.31	3.95	4.67	5.02	**3.74**	3.50	2.40
Cl^{-}	9.50	14.10	15.90	18.50	**14.50**	11.40	16.90
SO_4^{2-}	<10	8.13	11.70	15.50	**<11.33**	16.00	11.80

Hydrology

Lough Digh lies at approximately the same altitude as Upper Lough Erne and is connected to it through adjacent wetlands. Water levels are therefore partly governed by the hydrology of ULE with periodic winter flooding caused by the increased water level maintained by the Rivers Agency at Portora (Enniskillen). There is no evidence that high winter water levels adversely affect the condition at Lough Digh.

Lake substrate

The lake substrate is predominantly silty which is consistent with the underlying geology and alluvial soils in the catchment.

Sediment load

The lake is surrounded by rough pasture but there is no clear evidence of increased sediment loading from agricultural improvement or poaching. No further evidence of increased sediment load was noted from the catchment.

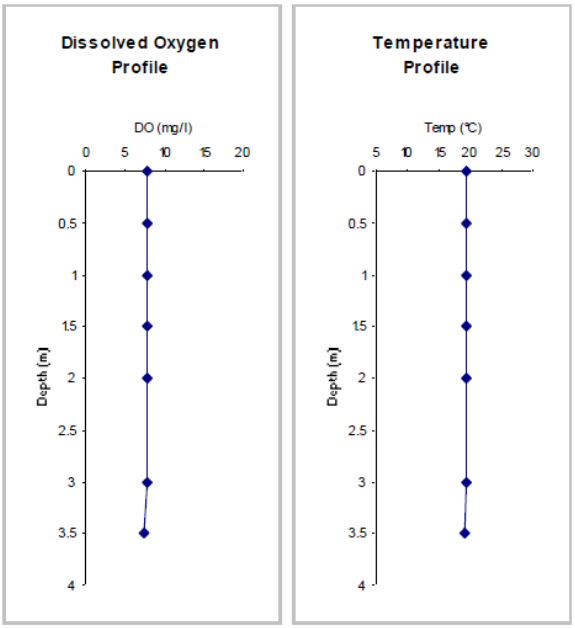
Figure 62 Dissolved oxygen and temperature profile for Lough Digh (28/07/2014)

Dissolved Oxygen Profile

GPS Location	H3240033236
Maximum Depth (m)	3.8 m
Secchi Depth (cm)	1.47 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	7.86	19.5
0.5	7.84	19.5
1	7.83	19.5
1.5	7.78	19.5
2	7.76	19.5
3	7.75	19.4
3.5	7.33	19.3



Indicators of local distinctiveness

The very rare marsh pea *Lathyrus palustris* was recorded in both the 2006 and 1988 survey and is thought to be on the increase in Ireland (Preston *et al.* 2002). However, this species was not recorded in the 2014 survey, most likely having been overlooked.

Summary

Though the Lough meets the criteria for submerged and floating leaved flora, supporting seven of the characteristic species, it has high mean annual TP and TN concentrations. Also the abundance of the recently colonised *E. nuttallii* fails to meet guideline standards (JNCC, 2015). Lough Digh is therefore classified as **unfavourable** and the site's aquatic macrophyte flora, although currently good, may be at risk due to the high nutrient concentrations and competition from *E. nuttallii***.** The water was clear in the dense plant beds but turbid in the open water, further demonstrating the importance of maintaining aquatic vegetation in these eutrophic sites. No evidence of direct nutrient inputs were observed, though there is moderate grazing pressure from cattle. Less intensive agriculture around the lough would be beneficial, and nutrient inputs should be identified and controlled, especially if **favourable** status is to be attained in future. The site is used for boat angling. No zebra mussels were observed.

Table 304 Lough Digh: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Digh NI Lake 899	Unfavourable	TP exceeds upper permissible limit. *E. nuttallii* is a recent colonist to the site and occurs at high frequency. Fails characteristic species target.	Despite high TP and a high frequency of *E. nuttallii,* 5 characteristic species (including a broad-leaved *Potamogeton* species) were present at the lough and had good coverage. Any site management needs to focus on identifying and controlling nutrient sources to prevent any further decline. This includes any further agricultural improvement within the immediate catchment.

Species list

Table 305 List of all plant species recorded at Lough Digh

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	F
Sparganium erectum	R
Alisma plantago-aquatica	R
Equisetum fluviatile	R
Nuphar lutea	R
Schoenoplectus lacustris	R
Mentha aquatica	R
Sium latifolium	R
Ranunculus lingua	R
Juncus acutiflorus	R
Myosotis scorpioides	R
Iris pseudacorus	R
Salix sp.	R
Alnus glutinosa	R
Caltha palustris	R
Cicuta virosa	R
Senecio aquaticus	R
Galium palustre	R
Hydrocotyle vulgaris	R
Carex sp.	R
Lysimachia nummularia	R
Ranunculus flammula	R
Menyanthes trifoliata	R
Potentilla palustris	R
Lychnis flos-cuculi	R
Juncus effusus	R
Rumex hydrolapathum	R
Eleocharis palustris	R
Stachys palustris	R
Filipendula ulmaria	R
Lysimachia vulgaris	R
Carex rostrata	R
Typha latifolia	R
Scutellaria galericulata	R

Submerged & floating species	% Frequency (n = 74)
Ceratophyllum demersum	1
Chara globularis	9
Elodea canadensis	3
Elodea nuttallii	73
Fontinalis antipyretica	6
Lemna minor	34
Lemna trisulca	84
Menyanthes trifoliata	6
Myriophyllum spicatum	20
Nitella flexilis agg.	49
Nuphar lutea	30
Potamogeton pusillus	1
Potamogeton obtusifolius	19
Potamogeton pectinatus	3
Potamogeton perfoliatus	6
Ranunculus aquatilis	1
Sparganium emersum	26
Spirodela polyrhiza	21
Utricularia vulgaris agg.	33
Oenanthe aquatica	+

Survey Data

Site Condition Assessment: Digh Lough (28/07/2014)

Lake Details		**Survey Details**		
Lake Name	Digh Lough	Survey Date	28/07/2014	
SSSI Name		Surveyors	SD & EW	
SAC Name		Shore Surveys	2	out of
Grid Ref	H324332	Wader Surveys	2	2
WBID / NI No.	50170 / 909	Boat Surveys	2	sections

Site Notes:

Survey Notes:
Dead Roach or Rudd plus a few small dead fish.
Large patches of circular formations of Pot. Perf and Pot. Pec off transect.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	150 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	12 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	130 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	7 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H3257033266	H3249833351	H3253533285	H3245033268
Section	**2**	H3235433084	H3225233082	H3231633097	H3232033145

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0082	0083	0084
Section	**2**	0085	0086	0087

3.60. Lough Doo (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	28 July 2014
NI Lake Number:	912
WBID:	50178
County:	Fermanagh
Grid reference:	H346301
OS Grid reference (X,Y):	234626,330070
Shoreline development index:	1.232
Surface area (ha.):	5.0
Maximum recorded depth (m):	2.6

Table 306 Condition Assessment Summary Table for Lough Doo

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	None noted
Macrophyte community composition	≥ 6 characteristic species, including 1 broad-leaved *Potamogeton* spp.	**X**	4 present: *Potamogeton obtusifolius, Potamogeton perfoliatus, Spirodella polyrhiza* and *Utricularia vulgaris*. (including 1 broadleaved *Potamogeton* spp. *(P. perfoliatus)).*
	No loss of characteristic species	**X**	*Chara globularis* recorded in 2006 but not 2014. *S. polyrhiza* is an additional species for 2014.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic sp.	✓	92% of vegetated sample spots comply (93% wader, 89% boat)
Negative indicator species	Negative indicator species absent or at low frequency	✓	*P. pectinatus* recorded, but at low abundance.
	Non-native species absent or present at low frequency	**X**	*Elodea nuttallii* recorded at 27% of survey sample points – absent from 1988 and 2006 surveys. *Elodea canadensis* recorded at 24% of survey sample points. One zebra mussel found on boat transect (S2).
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	No sampling points had filamentous algae cover of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓	Lough fringed by *P. australis* and *S. lacustris* all around to ~25-50cm. Species rich emergent zone (*Caltha palustris, C. rostrata, Cicuta virosa, E. fluviatile, Filipendula ulmaria, H. vulgaris, I. pseudacorus, J. articulates, J. effusus, M. trifoliata and P. arundinacea* most abundant). Open water fringed by extensive zone of *N. lutea* –abundant 25-80cm. *U. vulgaris* common throughout (50-80 cm). *P. natans* frequent in depths ≥50-75 cm, intermingled with *L. trisulca* and *S. polyrhiza* (abundant S2). *E. canadensis* and *E. nuttallii* frequent in depths 50-80 cm. Localised beds of *P. perfoliatus* and *P. pectinatus* at ~80cm at edge of *N. lutea* zone in S1. Limited zonation evidenced, but thought favourable for very shallow site.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 2.6 m, Z_s = 0.86 m, Z_v = 0.8 m. Z_v lower than in 2006
	At least the present structure should be maintained	✓	No change in present structure.
Water quality	Stable nutrients levels: TP target / limit = 50 μgl^{-1} (range = 35 – 100)	✓	TP = 41 μgl^{-1} (range = 29-63); TN = 1.02 mgl^{-1} (April '15 – Feb. '15)
	Stable pH values: pH ~ 7.0 – 9.0	✓	pH = 7.5 (range = 7.1 – 7.8)

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	-	Dissolved oxygen not recorded due to a technical fault.
	No excessive growth of cyanobacteria or green algae	✓	No algal blooms observed
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Reed fringed with minimal disturbance from cattle poaching
	Natural and characteristic substrate maintained	✓	No evidence of change
Sediment load	Natural sediment load maintained	✓	Catchment land-cover mainly wet (boggy) unimproved rough grazing and pasture. Grazing observed but no evidence of significantly increased sediment loads
Indicators of local distinctiveness	Distinctive elements maintained	-	None noted
	Minimal negative impacts and no fish farming	✓	Some grazing pressure from cattle around margins and slight poaching.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 5 ha, with no apparent loss of extent of open water.

Macrophyte community composition

The aquatic vegetation recorded in Lough Doo is typical of an enriched lowland flora and is most closely associated with the Type G lake assemblage (Duigan *et al.*, 2006). Four characteristic species were recorded in 2014: *Potamogeton obtusifolius, Potamogeton perfoliatus, Spirodella polyrhiza* and *Utricularia vulgaris,* which includes the broadleaved species *P. perfoliatus.* Two species were not recorded in the survey, which appeared in 2006: *Chara globularis* and *Potamogeton berchtoldii.* Although they were absent, they may simply have not occurred within the surveyed sections. One additional characteristic species was recorded in 2014, *S. polyrhiza.* With a total of four characteristic species and a high abundance of these species across the survey sections (97% of vegetated sample spots recorded ≥ 1 characteristic species), Lough Doo meets the favourable condition targets for macrophyte community composition. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan *et al,* 2006) of the site were 8.1 and 7.15 respectively (Table 307). The TRS score is almost identical to that derived from the survey in 2006, but the PLEX score is slightly lower. The difference in trophic scores since the previous survey is primarily due to more species being recorded in 2006, many of which were at low abundance, rather than any change in trophic status.

Table 307 Aquatic macrophyte community composition for Lough Doo, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=58)***	**TRS**	**PLEX**	**% occurrence (n=59)***
Chara globularis	8.5	7.69	29	-	-	-
Elodea canadensis	8.5	7.95	47	8.5	7.95	24
Elodea nuttallii	-	-	-	-	7.95	27
Lemna minor	9.0	8.85	4	9.0	8.85	31
Lemna trisulca	10.0	8.85	53	10.0	8.85	85
Menyanthes trifoliata	-	-	13	-	-	10
Nitella mucronata	-	-		5.5	5.38	5
Nuphar lutea	8.5	6.92	67	8.5	6.92	83
Potamogeton berchtoldii	7.3	7.69	7	-	-	-
Potamogeton natans	6.7	4.23	33	6.7	4.23	41
Potamogeton obtusifolius	7.3	6.54	51	7.3	6.54	20
Potamogeton pectinatus	10.0	8.85	4	10.0	8.85	12
Potamogeton perfoliatus	7.3	7.69	7	7.3	7.69	7
Potamogeton pusillus	8.5	7.95	15	9.0	7.95	2
Sparganium emersum	10.0	7.50	44	10.0	7.50	49
Spirodela polyrhiza	-	-	-	-	-	53
Utricularia vulgaris	5.5	4.23	80	5.5	4.23	53
Average score	8.2	7.30		8.1	7.15	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

The non-native *Elodea canadensis* was recorded as occasional in 1988 ("2" on a 1-5 abundance scale), in 2006 it was recorded at an overall abundance of 47%, while in 2014 it was recorded with an overall abundance of 24%. This suggests that *E. canadensis* has been a component of Lough Doo's aquatic macrophyte community for at least 26 years.

Elodea nuttallii was also recorded in the 2014 survey (27% frequency), but not in 2006. Under the CSM guidelines (JNCC 2015), colonisation of this species since the previous field visit deems the site to be in unfavourable condition. Therefore Lough Doo fails this target. It is not known whether the relatively high abundance of *E. canadensis or E. nuttallii* is having a detrimental impact upon the growth of other aquatic species or characteristic flora. One zebra mussel was found, on the boat transect in S2, most likely to have originated from Upper Lough Erne.

Macrophyte community structure

Lough Doo is surrounded by a rich stand of emergent and marginal vegetation comprising mainly a *Scirpo-Phragmitetum* community dominated by *Phragmites australis* and *Schoenoplectus lacustris*, growing in water depths of 25 - 50 cm. Towards the landward side, the lough's margins are dominated by boggy ground topped by both wet woodland, alder carr and tall herb-rich emergent vegetation dominated by: *Caltha palustris, C. rostrata, Cicuta virosa, E. fluviatile, Filipendula ulmaria, H. vulgaris, I. pseudacorus, J. articulates, J. effusus, M. trifoliata and P. arundinacea*. Beyond this community, *Nuphar lutea* fringes the open water extensively, often at depths of 50-75 cm, intermingled with *L. trisulca* and *S. polyrhiza. E. canadensis* and *E. nuttallii* both equally frequent depths of 50-80 cm, often among the submerged *N. lutea* growth. Localised and limited beds of *P. perfoliatus* and *P. pectinatus* are found in S1 at ~80 cm, on the edge of the *N. lutea* zone. The current community structure is thought to be favourable. A full species list is given in Table 310 below.

Water quality

Table 308 Water chemistry data for Lough Doo

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1990
TP	39.7	62.7	28.7	32.5	**40.9**	54.0	49
SRP	0.052	0.036	0.010	0.014	**0.028**	-	8
TN	0.94	0.85	1.15	1.15	**1.02**	1.18	1.33
TON	0.005	0.007	0.118	0.286	**0.104**	-	-
Nitrite	0.001	0.001	0.008	0.002	**0.003**	-	-
Chl a	5.06	2.3375	1.54	1.54	**2.62**	5.00	10.08
DOC	16.30	18.10	18.50	15.20	**17.03**	-	-
pH	7.67	7.35	7.76	7.14	**7.48**	8.10	7.91
Alk	118	146	136	70	**117**	98	73
Cond	284	339	319	241	**296**	298	360
Ca^{2+}	40.20	58.70	51.10	33.40	**45.85**	46.20	68
Mg^{2+}	3.14	5.20	4.94	2.95	**4.06**	3.60	4.4
Na^{+}	6.96	10.60	11.00	15.30	**10.97**	14.60	11.8
K^{+}	1.31	1.75	2.06	1.51	**1.66**	1.40	1.65
Cl^{-}	17.10	17.30	18.20	29.70	**20.58**	9.80	21.54
SO_4^{2-}	10.80	13.80	22.40	13.70	**15.18**	28.10	28.1

Lough Doo is a very shallow (Z_{max} recorded = 2.6 m), high alkalinity lough. The mean annual TP concentration (41 μgl^{-1}) and the range (29-63 μgl^{-1}) have improved significantly since the last survey in 2006, and placing the trophic status of the lough in favourable condition. The water was clear during the summer survey and Chl *a* levels remained very low during the sampling period, with an overall average of 2.62 μgl^{-1}, placing the lough's water quality status in 'favourable' condition. Furthermore, no cyanobacterial or other algal blooms were observed. Filamentous algae were recorded at moderate abundance in 2006, yet in 2014 it has reduced to 1%

frequency only in the wader survey. These data suggests that the majority of nutrient uptake is by plants and benthic algae, which is preferable to phytoplankton dominance. In summer 1988, a spot water sample recorded a TP concentration of 49 μgl^{-1}, and although no firm conclusions can be drawn from these two sets of independent data, TP concentrations between 1988 and 2014 appear to have remained relatively stable.

Hydrology

Lough Doo is fed by a small stream which enters the lough from the northeast. The lough lies at approximately the same altitude as Upper Lough Erne and is linked to the Lough by an outflow to the north. Water levels are therefore partly governed by the hydrology of ULE with periodic winter flooding caused by the increased water level maintained by the Rivers Agency at Portora (Enniskillen). There is no evidence that high winter water levels adversely affect the condition of Lough Doo.

Lake substrate

The lake substrate is predominantly silty, which is consistent with the underlying geology and alluvial soils in the catchment. Some of the shallowest areas of S1 comprise root mass.

Sediment load

With the exception of small areas of poaching by cattle, there is no evidence of increased sediment loadings from the catchment.

Indicators of local distinctiveness

Sium latifolium was recorded at Lough Doo in 2006 and is listed as a “priority species” for Northern Ireland (www.habitas.org.uk, 2007). It was not recorded in 2014, although it may simply have been missed from the survey sections. Otters are frequent in the ULE SAC, but no evidence was noted for Lough Doo.

Summary

The 2014 survey results place Lough Doo in **unfavourable** condition. This is despite the lough supporting a relatively species rich characteristic aquatic macrophyte flora. The number of characteristic species (four, including one broadleaved *Potamogeton* spp.) does not meet the favourable condition target, although the abundance of these species across both the wader and boat transects (92%) does meet the species abundance target of >60% of sample spots having 1 or more characteristic species.

The TP concentration has improved since it was last surveyed in 2006, moving water quality into favourable status. The aquatic macrophyte TRS and PLEX scores also suggest that the lough’s trophic status is similar to that calculated from the 1988 and 2006 survey data.

The primary reason for failure is the recent arrival of the non-native species *Elodea nuttallii* (27% frequency) alongside an established population of *E. canadensis*; this automatically classifies the site as being in unfavourable condition. The presence of zebra mussels is also of concern.

Table 309 Lough Doo: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Doo NI Lake 912	Unfavourable	Only 4 characteristic species present Recent colonisation by *E. nuttallii (*27%)	Moderately species rich and abundant aquatic macrophyte flora - stable since 1988. TP concentration (mean and range) = favourable – most other variables (e.g. Chl *a* / water clarity) suggest favourable water quality.

Species List

Table 310 List of all plant species recorded at Lough Doo

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Alnus glutinosa	F
Angelica sylvestris	R
Apium nodiflorum	R
Caltha palustris	R
Carex nigra	R
Carex rostrata	O
Carex sp.	R
Cicuta virosa	R
Eleocharis palustris	R
Epilobium parviflorum	R
Equisetum fluviatile	O
Equisetum palustre	R
Filipendula ulmaria	R
Galium palustre	R
Hydrocotyle vulgaris	F
Iris pseudacorus	F
Juncus articulatus	F
Juncus effusus	F
Lycopus europaeus	R
Lysimachia nummularia	R
Lythrum salicaria	R
Mentha aquatica	F
Menyanthes trifoliata	O
Myosotis scorpioides	R
Phalaris arundinacea	F
Phragmites australis	F
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	F
Stellaria palustris	R

Submerged & floating species	% Frequency (n = 59)
Elodea canadensis	24
Elodea nuttallii	27
Lemna minor	31
Lemna trisulca	85
Menyanthes trifoliata	10
Nitella mucronata	5
Nuphar lutea	83
Potamogeton natans	41
Potamogeton obtusifolius	20
Potamogeton pectinatus	12
Potamogeton perfoliatus	7
Potamogeton pusillus	2
Sparganium emersum	49
Spirodela polyrhiza	53
Utricularia vulgaris	53

Survey data

Site Condition Assessment: Doo Lough (28/07/2014)

Lake Details		**Survey Details**		
Lake Name	Doo Lough	Survey Date	28/07/2014	
SSSI Name		Surveyors	SG, EF	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H346301	Wader Surveys	2	2
WBID / NI No.	50178 / 912	Boat Surveys	2	sections

Site
Surface sediments taken at 1.0m H3461030039 towards NE corner of lough. Met an eel fisherman who sets eel nets

Survey
One zebra mussel found on boat transect 2

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	50 °
		Lateral distance from waters edge to 75cm depth (m)	40 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	80 cm
		Compass bearing of boat transect (°)	225 °
		Lateral distance from waters edge to 75cm depth (m)	30 m
		Notes: Zebra mussel found on boat survey	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H3469130160	H3463930245	-	H3460130140
Section	**2**	H3455829922	H3453730031	H3455029966	H3465630022

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	125-0303	125-0305	125-0304
Section	**2**	125-0302	125-0301	125-0299

3.61. Drummully Lough (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	29 July 2014
NI Lake Number:	914
WBID:	50160
County:	Fermanagh
Grid reference:	H307287
OS Grid reference (X,Y):	230690,328716
Shoreline development index:	1.151
Surface area (ha.):	8.7
Maximum recorded depth (m):	0.80

Table 311 Condition Assessment Summary Table for Drummully Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓?	Encroachment of reed beds into open water areas to the west of the lough, resulting in the natural loss of standing water only.
Macrophyte community composition	≥ 6 characteristic species and 1 broad-leaved *Potamogeton* spp.	X	Only 2 present: *Chara globularis* and *Spirodella polyrhiza.* No broadleaved *Potamogeton* spp. present.
	No loss of characteristic species	X	1 species present in 1990 and not recorded in 2014 – *Potamogeton perfoliatus. S. polyrhiza* gained in 2014.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	58% of vegetated sample plots comply (83% wader, 10% boat)
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*P. pectinatus* has increased significantly since 1990 (now 'abundant')
	Non-native species absent or present at low frequency	**X**	*E. canadensis* present but at low frequency ('rare'). Has not increased since 1990. *L. minuta* recorded as 'occasional' in 2014.
	Filamentous Algae (non-*Chara*) <20% of points scoring '3'	✓	Very low filamentous algae cover: <1% of sampling points with a cover of '3'
Macrophyte community structure	Characteristic vegetation zones should be present	✓**?**	Site too shallow to exhibit typical zonation, but well developed and species rich marginal / emergent zone (*E. fluviatile, P. australis, S. lacustris, S. erectum, T. latifolia*). Localised beds of *N. lutea* (S2, 50-80 cm) intermingled by *L. minuta* and *L. minor. L. minuta* most prolific in S1, with *S. polyrhiza* (25->75 cm). *P. pectinatus* dominant in open water (25-85 cm) while *E. canadensis* dominant in patches (25- >75 cm). *P. pusillus* very rare (S1 & S2 at >75 cm). *C. globularis* formed in localised beds in S2 (50- >75 cm) while *S. emersum* rare, S2 50-75 cm.
	Maximum depth distribution should be maintained	✓	Z_{max} = 0.8 m, Z_s = 0.26 m, Z_v = 0.8 m
	At least the present structure should be maintained	**-**	Previous data insufficient for comparison.
Water quality	Stable nutrients levels: TP target / limit = 50 μgl^{-1}	**X**	TP = 246.1 μgl^{-1} (range 79-667) TN = 3.52 mgl^{-1} (April '14 – Feb. '15)
	Stable pH values: pH ~ 7.0 – 9.0	✓	pH = 7.7 (range = 7.3 – 8.3)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	✓	Well mixed and oxygenated throughout the water column: mean DO value = 24.98 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	**X**	High green algal concentrations as evidenced by Chl *a*.
Hydrology	Natural hydrological regime	✓	Appears natural.

Attribute	Target	Status	Comment
Lake substrate	Natural shoreline maintained	✓?	Reed fringed with minimal disturbance to the majority of shore – some riparian macrophyte cutting observed on north shore.
	Natural and characteristic substrate maintained	✓	Shallow water dominated by root mass, silty substrates beyond 50 cm depth.
Sediment load	Natural sediment load maintained	✓	Catchment predominantly improved grazing/pasture. No grazing or poaching observed and no evidence for increased sediment load.
Indicators of local distinctiveness	Distinctive elements maintained	✓	None specified.
	Minimal negative impacts and no fish farming	✓	No grazing or poaching observed at time of survey although lough is surrounded by pasture to all sides.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 8.7 ha, but the marginal areas of the western shore consist of extensive *Scirpo-Phragmitium* which has encroached into the very shallow open water resulting in some natural loss of extent.

Macrophyte community composition

The aquatic macrophyte assemblage at Drummully Lough is generally poor in diversity, with only nine submerged and floating leaved species, two of which are characteristic for this lake type. *Chara globularis* was present in very low abundance and generally restricted to the margins. *Spirodella polyrhiza* dominated the shallows along the southern shore – along with *Lemna minuta* – which significantly increased the frequency of vegetated sample plots comprising of characteristic species (58% overall). Other aquatic macrophyte species which were recorded include: *Elodea canadensis, Nuphar lutea, Potamogeton pectinatus* and *Sparganium emersum.* The open water was dominated by dense beds of *P. pectinatus*, with *N. lutea* appearing occasionally. *Potamogeton pectinatus* is currently classed as 'dominant' ('5' on a 1-5 scale) whereas in 1990 it was recorded as 'frequent' ('3' on a 1-5 scale). Similarly, *Lemna minor* has significantly decreased over the past 24 years, but has been replaced by *L. minuta* which dominates the shallows with *S. polyrhiza* on the southern shore.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site are 8.7 and 7.96, respectively (Table 311). The slight increase in scores derived from the 1990 NILS survey data (8.3 and 7.78 respectively) supports the possibility that eutrophication of the lough has increased the frequency of pollution tolerant species, although conclusions must be treated with caution as differing survey methods were used between 1990 and 2014. No broadleaved *Potamogeton* species were recorded in 2014, although *P. perfoliatus* was observed in 1990 as

'frequent'. *Lemna trisulca* was also abundant during the 1990 survey, but absent from the recent survey.

In contrast to the open water, the marginal flora is species rich and extensive and a good example of the *Scirpo-Phragmitetum* community normally associated with this site type. Towards the waters edge *Equisetum fluviatile, Schoenoplectus lacustris*, *Phragmites australis, Sparganium erectum* and *Typha latifolia* are dominant, with a species rich under storey which merges into wet grazing (see Table 315).

Table 312 Aquatic macrophyte community composition for Drummully Lough, including trophic scores

	1990 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=60)***
***Chara* spp.**	**8.5**	**7.69**	**2**	**-**	**-**	**-**
Chara globularis	**8.5**	**7.69**	**+**	**7.3**	**7.69**	**8**
Elodea canadensis	8.5	7.95	3	7.3	7.95	17
Lemna minor	9.0	8.85	5	9.0	8.85	5
Lemna minuta	-	-	-	-	-	52
Lemna trisulca	10.0	8.85	5	-	-	-
Nitella flexilis	5.5	5.38	+	-	-	-
Nuphar lutea	8.5	6.92	2	8.5	6.92	20
Potamogeton pectinatus	10.0	8.85	3	10.0	8.85	63
Potamogeton perfoliatus	**7.3**	**7.69**	**3**	**-**	**-**	**-**
Potamogeton pusillus	8.5	7.95	5	8.5	7.95	3
Sparganium emersum	-	-	-	10.0	7.5	3
Spirodela polyrhiza	**-**	**-**	**-**	**-**	**-**	**57**
Average score	**8.4**	**7.78**		**8.7**	**7.96**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys.

Negative indicator species

The presence of *E. canadensis* has been intrinsic to the aquatic flora since 1990, when it was recorded as 'frequent'. It is now considered be 'rare' in lough, with an overall frequency of 17% and occurs in small patches which do not appear to be damaging to the surrounding plant community. By contrast, *P. pectinatus* has flourished in the shallow waters and is classed as 'abundant' on a 1-5 scale. It was previously recorded as 'frequent' and appears to have colonised the open water to the detriment of other submerged species. *Lemna minuta* was recorded in Drummully Lough as a new species, and covered the surface water on the southern side of the lough, with *S. polyrhiza,* which severely restricted light penetration into the water column. Despite the close proximity to Upper Lough Erne, no zebra mussels were found during the survey.

Macrophyte community structure

Drummully Lough is surrounded by a rich stand of emergent and marginal vegetation comprising mainly of a *Scirpo-Phragmitetum* community, including *Carex nigra, Carex riparia, Hydrocotyle vulgaris, Ranunculus flammula, Iris pseudacorus, Alisma plantago-aquatica, Caltha palustris* and *Myosotis scorpiodes*. The *Phragmites australis, Schoenoplectus lacustris, Sparganium erectum* and *Typha latifolia* community extends into the lough by approximately 10 m, at which point the reeds abruptly end at the edge of open water. *Spirodella polyrhiza* and *Lemna minuta* dominate the shallow waters within the reeds (25 - >75 cm) at the southern end of the lake, often preventing light from penetrating the water column. *Nuphar lutea* forms patches from the edge of the reeds to the open water on the northern side (50 – 80 cm depth), which are intermingled by occasional *L. minuta* and *Lemna minor*. *Elodea canadensis* was also found to be growing within this zone, dominant in small areas but seemingly not detrimental to the surrounding plant community. *Chara globularis* formed localised beds within this area, at depths between 50 - >75 cm, while *Sparganium emersum* was recorded in rare abundance between 50 – 75 cm. *Potamogeton pusillus* was rarely recorded, appearing in S1 and S2 only once apiece at a depth of >75 cm. By comparison, *Potamogeton pectinatus* significantly dominates the open water (25 – 85 cm) across the lough, possibly to the detriment of other aquatic plant species. It must be noted that where *S. polyrhiza* and *L. minuta* thrives on the southern shore, submerged species diversity is not as rich. A full species list is given in Table 315 below.

Water quality

Table 313 Water chemistry data for Drummully Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '14	Mean	1990
TP	121.0	667.0	117.0	79.5	**246.1**	92
SRP	26.0	94.0	13.0	15.0	**37.0**	44
TN	2.06	8.22	2.56	1.22	**3.52**	1.18
TON	0.007	0.005	0.451	0.090	**0.138**	-
Nitrite	0.004	0.001	0.009	0.003	**0.004**	-
Chl *a*	98.6	479.6	37.4	39.4	**163.7**	4.95
DOC	11.90	28.60	13.70	8.37	**15.64**	-
pH	7.65	8.28	7.27	7.59	**7.57**	9.91
Alk	133	94	129	116	**118**	77
Cond	296	216	314	270	**274**	229
Ca^{2+}	47.90	32.00	50.00	40.80	**42.68**	33.8
Mg^{2+}	4.47	3.94	4.45	4.00	**4.22**	3.6
Na^{+}	9.21	9.15	9.32	10.30	**9.50**	11.8
K^{+}	5.30	5.32	4.95	4.99	**5.14**	2.7
Cl^{-}	15.90	16.40	17.30	20.10	**17.43**	21.18
SO_4^{2-}	<10	9.82	24.30	12.20	**14.08**	19.44

Drummully Lough is a very shallow, high alkalinity lake with a mean annual TP of 246 μgl^{-1}, classifying it as hyper-eutrophic and therefore placing it in the unfavourable category with respect to trophic status. Although this value is elevated somewhat by a single high value measured in August (667 μgl^{-1}), the other three seasonal measurement were also above the target concentration of 50 μgl^{-1}. The water chemistry of the lough appears to have declined since 1990 (NILS), when TP was recorded to be 92 μgl^{-1}. However, the 1990 data is based only on a summer spot-sample and direct comparison with the 2014 data should be treated with caution. Drummully Lough also exhibits a high mean annual TN of 3.52 μgl^{-1} which promotes algal productivity and can be detrimental to macrophyte diversity. This exceeds the recommended limit of 1.5 μgl^{-1} as set by CSM (JNCC 2015). It must be noted that a cyanobacterial algal bloom was observed during the April and August water sampling, which explains the high Chl *a* concentrations of 99 μgl^{-1} and 480 μgl^{-1} respectively for those months.

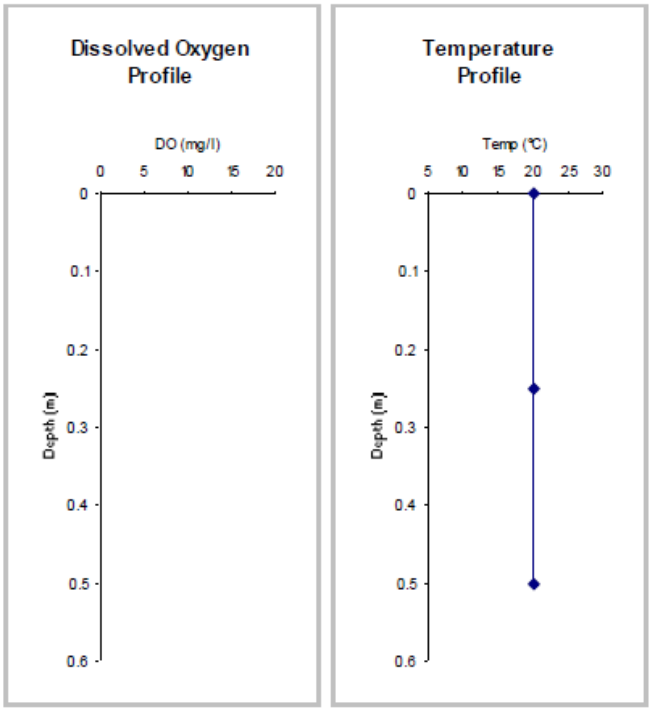
The dissolved oxygen (DO) concentration was high throughout the notably shallow water column, with DO measurements averaging 24.98 mgl^{-1} (Figure 63). The dense carpets of *Lemna minuta* and *Spirodella polyrhiza,* combined with the turbid water clarity, meant that light penetration only reached a depth of 0.26 m, which is possibly the reason for limited submerged aquatic flora diversity within the shallow and open waters. Drummully Lough fails to meet its condition target on the basis of its current mean annual TP (evidence that the trophic status is declining).

Figure 63 Dissolved oxygen and temperature profile for Drummully Lough (29/07/2014)

Dissolved Oxygen Profile

GPS Location	H3071328715
Maximum Depth (m)	0.8 m
Secchi Depth (cm)	26 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	25.35	20
0.25	24.9	20
0.5	24.7	20



Hydrology

The hydrological regime at the site appears natural.

Lake substrate
The lake substrate is entirely silty which is consistent with the underlying geology and alluvial soils in the catchment. Margins to the lake comprise predominantly organic material derived from the root mass beneath the reed fringe.

Sediment load
The catchment is comprised mainly of improved grazing and pasture. However, no grazing or poaching was observed during the survey and there is no additional evidence of increased sediment loadings from the catchment. Internally derived sedimentation is likely to be relatively high due to high nutrient loadings, which may in time reduce the extent of open water in what is already a very shallow water body.

Indicators of local distinctiveness
No indicators of local distinctiveness were specified during the 1990 survey, or observed during the 2014 survey.

Summary
Drummully Lough is hyper-eutrophic and fails to support the requite *Magnopotamion / Hydrocharition* plant species for its lake type. *Potamogeton pectinatus,* a negative indicator species, has dominated the open water to the detriment of other floating leaved and submerged plant species. Equally, *Lemna minuta* and *Spirodella polyrhiza* have blanketed the surface towards the southern end of the lake, limiting light penetration to the water column. For these reasons, Drummully Lough is classified as being in **unfavourable** condition.

This assessment is however based strictly within the standards set out by the Common Standards Monitoring Guidance (JNCC 2015) which focuses entirely on the open water assemblage of the lough and assumes the site to be at least in some way typical for its assigned type, i.e. natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation. However, Drummully Lough is so shallow it falls outside many of the typical criteria assigned to this site type and will inevitably be exposed to greater physical stresses without any significant water depth through which environmental stresses are normally buffered in lakes (e.g. temperature, wind stress, de-oxygenation). In the past, although the site supported the same flora but with greater abundance, it still contained negative indicator species (*E. canadensis* & *P. pectinatus*). With so little water depth remaining in the lough, the site is thought unlikely to be able to sustain a characteristic flora, irrespective of future water quality, and the main threat to the site is likely to come from a reduction in extent through natural hydroseral succession rather than further eutrophication.

Table 314 Drummully Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Drummully Lough NI Lake 914	**Unfavourable**	Open water hyper-eutrophic, species-poor and dominated by *P. pectinatus* and *Lemna minuta.*	Site considered too shallow to support characteristic aquatic flora. Poor light penetration through water column.

Species List

Table 315 List of all plant species recorded at Drummully Lough: 2014

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Angelica sylvestris	R
Caltha palustris	R
Carex nigra	R
Carex riparia	R
Carex rostrata	F
Cicuta virosa	R
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum fluviatile	O
Equisetum palustre	R
Galium palustre	O
Hydrocotyle vulgaris	O
Iris pseudacorus	R
Juncus articulatus	F
Juncus effusus	R
Lycopus europaeus	R
Lysimachia nummularia	R
Mentha aquatica	R
Myosotis scorpioides	O
Oenanthe fistulosa	F
Phragmites australis	F
Ranunculus flammula	F
Rumex hydrolapathum	R
Sparganium erectum	F
Stellaria palustris	R
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 60)**
Chara globularis	8
Elodea canadensis	17
Lemna minor	5
Lemna minuta	52
Nuphar lutea	20
Potamogeton pectinatus	63
Potamogeton pusillus	3
Sparganium emersum	3
Spirodela polyrhiza	57

Survey data

Site Condition Assessment: Drummully Lough (29/07/2014)

Lake Details		**Survey Details**		
Lake Name	Drummully Lough	Survey Date	29/07/2014	
SSSI Name		Surveyors	SG, EF	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H307287	Wader Surveys	2	2
WBID / NI No.	50160 / 914	Boat Surveys	2	sections

Site Notes:
Very shallow lake

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	15 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H3085028617	H3075228589	H3079828622	H3080128675
Section	**2**	H3060628793	H3071428801	H3066428791	H3066728742

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	126-0305	126-0308	126-0307
Section	**2**	126-0309	126-0310	126-0311

3.62. Kilturk Lough (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	26 July 2006
NI Lake Number:	922
WBID:	50023
County:	Fermanagh
Grid reference:	H371260
OS Grid reference (X,Y):	237170,325841
Shoreline development index:	1.879
Surface area (ha.):	43.0
Maximum recorded depth (m):	3.4

Table 316 Condition Assessment Summary Table for Kilturk Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species and 1 broad-leaved *Potamogeton* spp.	**X**	3 characteristic species present in 2014: *Hydrocharis morsus-ranae, Potamogeton perfoliatus* & *Spirodela polyrhiza* (including 1 broad-leaved *Potamogeton* spp.– *P. perfoliatus*). *Stratiotes aloides* also present, but see text

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	6 characteristics in 2006, 3 in 2014 (*Chara virgata, Potamogeton crispus* and *Potamogeton obtusifolius* not recorded in 2014) and possible loss / decline of *L. uniflora,* as recorded in 1990.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	47% of vegetated sample spots comply
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 42% of submerged sample points (decreased from 59% in 2006).
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	Very low filamentous algae recorded (1% of wader sections); 0% of sampling points with cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	**✓?**	Good marginal habitat with mix or reed, herbs and wet woodland. *P. australis & S. lacustris* dominate the reed fringe (0-75 cm). Frequent marginal emergents: *A. plantago-aquatica, B. umbellatus, C. remota, C. rostrata, E. fluviatile, F. ulmaria, I. pseudacorus, J. effusus, Menyanthes trifoliate, Persicaria amphibian, P. arundinacea* and *S. erectum*. *L. trisulca* dominates ≤ 260 cm, intermingled with *S. polyrhiza* & often beneath zone of *N. lutea* (50–160 cm) and *H. morsus–ranae* (25–100 cm, S1 and S2). *Stratiotes aloides* the dominant species in S1 and S2, abundant in S3 (75-320 cm). Occasional *E. canadensis* in both deep & shallow water (50–260 cm), with occasional localised beds of *P. pusillus* (mostly 50-150 cm in S2). Some degree of zonation evident.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 3.4 m, Z_s = 2.42 m, Z_v = 3.1 m.
	At least the present structure should be maintained	✓	Hydrosere present – no change evident except for *S. aloides* dominance across a large extent of water (75-320 cm depth).

Attribute	Target	Status	Comment
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 147 μgl^{-1} (range = 72 - 320) & TN = 1.04 mgl^{-1} (April '14 – Feb. '15)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.6 (range = 7.3 – 7.8)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	✓	Lake well mixed throughout the water column; mean DO reading = 9.02 mgl^{-1} (greater than HES value for eutrophic waters)
	No excessive growth of cyanobacteria or green algae	**X**	None recorded at time of survey.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No clear evidence of increased sediment loads - some poaching.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	*S. latifolium* (priority species for NI) present. Broad-leaved *Potamogeton* spp. present.
	Minimal negative impacts and no fish farming	✓**?**	Some poaching of shore. Zebra mussels recorded in 2006 but not 2014.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 43 ha, with no loss of extent of open water.

Macrophyte community composition

Kilturk Lough has a species rich submerged and floating leaved aquatic macrophyte flora overall (19 species). In 2014, only three characteristic species were recorded; *Hydrocharis morsus-ranae, Potamogeton perfoliatus* and *Spirodela polyrhiza.* This included one broad-leaved *Potamogeton* sp. (*P. perfoliatus*). *Stratiotes aloides* cannot be included as a characteristic species as it believed to be introduced to Northern Ireland. The lough also has a rich marginal and emergent flora; 63 different aquatic macrophyte taxa were recorded in 2014. Notable species included *Butomus umbellatus* and *Sium latifolium* (a priority species for NI).

The extent of *Stratiodes aloides* has expanded significantly since 2006, when it was recorded with a total frequency of 5%. It is recorded as the dominant species in S1 and S2 in the recent survey, with a total abundance of '3' out of '3'.The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.5 and 7.36 respectively (Table 317). Comparison with scores calculated from the 1990 survey species data (7.6 and 6.98 respectively) suggests that there has been a slight increase in trophic status. Examination of the 1990 and 2014 species data may support this conclusion; the absence of *Littorella uniflora* from the 2006 and 2014

surveys and the appearance (albeit at low abundance) of *Potamogeton pectinatus* both suggest enrichment. However, care should be taken in drawing firm conclusions from the comparison of data collected using different sampling methods. Further investigation is recommended.

Table 317 Aquatic macrophyte community composition for Kilturk Lough, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=64)***	**TRS**	**PLEX**	**% occurrence (n=86)***
Chara virgata	**8.5**	**7.69**	**9**	**-**	**-**	**-**
Elodea canadensis	8.5	7.95	59	8.5	7.95	42
Fontinalis antipyretica	6.3	5.38	20	6.3	5.38	10
Hydrocharis morsus-ranae	**-**	**-**	**16**	**-**	**-**	**7**
Lemna minor	9.0	8.85	28	9.0	8.85	28
Lemna trisulca	10.0	8.85	77	10	8.85	86
Myriophyllum spicatum	9.0	8.85	6	-	-	-
Nuphar lutea	8.5	6.92	53	8.5	6.92	45
Nymphaea alba	6.7	3.08	2	6.7	3.08	5
Potamogeton crispus	**8.5**	**7.95**	**3**	**-**	**-**	**-**
Potamogeton natans	6.7	4.23	5	-	-	-
Potamogeton obtusifolius	**7.3**	**6.54**	**11**	**-**	**-**	**-**
Potamogeton pectinatus	10.0	8.85	2	10.0	8.85	3
Potamogeton perfoliatus	**7.3**	**7.69**	**2**	**7.3**	**7.69**	**1**
Potamogeton pusillus	9.0	7.95	55	8.5	7.95	12
Ranunculus aquatilis	-	-	-	8.5	7.95	1
Sagittaria sagittifolia	-	-	5	-	-	13
Spirodela polyrhiza	**-**	**-**	**25**	**-**	**-**	**47**
Stratiotes aloides	**-**	**-**	**2**	**-**	**-**	**65**
Sparganium emersum	-	-	-	10.0	7.50	+
Average score	**8.2**	**7.20**		**8.5**	**7.36**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys
A plus (+) denotes taxa recorded as present at the site but not found growing in the survey sections

Negative indicator species

Elodea canadensis was recorded at an overall abundance of 42%, which is a notable decrease since 2006, when it was recorded with a frequency of 59%.

Macrophyte community structure

Kilturk Lough's catchment comprises predominantly of rough pasture, although there is an area of mixed woodland along the western side of the lough and to the south

around the outflow. The lough has a good marginal habitat comprising a combination of reed, herbs and wet woodland. *Phragmites australis* and *Schoenoplectus lacustris* dominate the reed fringe, which occupies water depths of 0 - 75 cm. Other frequently encountered marginal emergent species include: *A. plantago-aquatica, B. umbellatus, C. remota, C. rostrata, E. fluviatile, F. ulmaria, I. pseudacorus, J. effusus, Menyanthes trifoliate, Persicaria amphibian, P. arundinacea* and *S. erectum*. The lough's submerged and floating leaved vegetation shows some degree of zonation. *L. trisulca* dominates around the margins at water depths of ≤ 260 cm and is often found growing beneath the zone of *N. lutea* (50 – 160 cm) and *H. morsus–ranae* (25 – 100 cm, S1 and S2). *S. polyrhiza* are found intermingled with *L. trisulca* at water depths ≤ 75 cm and predominantly in S1 and S2. *S. aloides* was found to be the dominant species in S1 and S2, and also frequent in S3. It was recorded in water depths of 75 – 320cm, and was so abundant that a boat survey in S1 was not possible due to very difficult manoeuvrability. *E. canadensis* is frequent in both deep & shallow water (50 – 260 cm), with some occasional localised beds of *P. pusillus* (at greatest abundance in water depths of 50 – 150 cm in S2). Aquatic macrophytes were found growing to a maximum depth of 3.1 m, although *S. aloides, E. Canadensis* and *L. trisulca* were growing beyond 3.2 m in S2, right across to the opposite shore. A full species list is given in Table 320 below.

Water quality

Table 318 Water chemistry data for Kilturk Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1990
TP	87.3	72.0	320.0	109.0	**147.1**	111.0	45
SRP	59.0	37.0	259.0	91.0	**111.0**	-	5
TN	0.90	0.79	1.27	1.18	**1.04**	0.92	1.05
TON	0.006	0.005	0.168	0.392	**0.143**	-	-
Nitrite	0.001	0.001	0.005	0.005	**0.003**	-	-
Chl a	16.39	4.62	2.97	3.01	**6.75**	9.00	8.54
DOC	10.50	10.00	11.30	8.79	**10.15**	-	-
pH	7.78	7.25	7.81	7.67	**7.56**	8.10	8.28
Alk	135	123	114	100	**118**	89	67.0
Cond	302	244	267	255	**267**	303	332
Ca^{2+}	52.6	42.9	43.6	43.3	**45.6**	48.40	64.2
Mg^{2+}	4.42	4.04	4.50	3.73	**4.17**	4.60	5
Na^{+}	8.24	6.88	8.37	7.87	**7.84**	7.00	11.55
K^{+}	4.20	0.61	4.28	3.81	**3.23**	4.70	2.4
Cl^{-}	14.40	10.80	13.40	12.50	**12.78**	8.20	20.14
SO_4^{2-}	13.20	10.90	15.00	14.00	**13.28**	26.80	33.53

Kilturk Lough is a shallow (Z_{max} recorded = 3.4 m), hyper-eutrophic lake with high annual mean TP (147 $\mu g l^{-1}$) which classifies it as "unfavourable" with respect to trophic status and places it within the "poor" ecological status for this lake type under the more stringent criteria set by the UK WDF TAG reports (2006). The mean annual

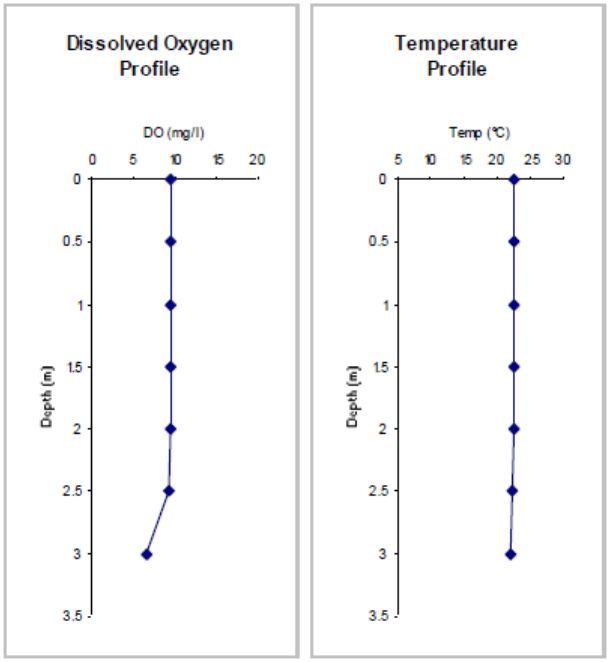
chlorophyll *a* concentration is within the acceptable range for the lake type. In summer 1990, a spot water sample recorded a TP concentration of 45 μgl^{-1}, and although no firm conclusions can be drawn from these two sets of independent data, TP concentrations between 1990 and 2014 do appear to have increased. However, as can be seen from the 2014 TP data, there is considerable intra-annual variation in TP, with the lower concentrations being recorded in the spring and late summer, coinciding with the 1990 spot sample date and perhaps suggesting no significant change in TP between 1990 and 2014. The highest TP concentration appears in November 2014, perhaps indicating surface run-off and percolation of nutrient-enriched water into the lake from the adjacent pasture. At the time of survey in July 2014, the upper 2.0 m of the water column were well oxygenated and mixed (9.48 mgl^{-1}), with an average reading of 9.02 mgl^{-1} throughout the entire water column, which is higher than the HES standard, as referenced in the CSM guidance (JNCC) 2015 (Figure 64).

Figure 64 Dissolved oxygen and temperature profile for Kilturk Lough (26/07/2014)

Dissolved Oxygen Profile

GPS Location
Maximum Depth (m) 3.4 m
Secchi Depth (cm) 242 cm
Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	9.45	22.4
0.5	9.48	22.4
1	9.47	22.4
1.5	9.5	22.4
2	9.48	22.4
2.5	9.3	22.3
3	6.5	22



Hydrology

Kilturk Lough receives its water via a stream from Sand Lough which lies to the northeast. Sand Lough is in turn fed by a series of smaller loughs and an extensive network of channels passing through areas of marshland to the northeast. Kilturk Lough drains to the southwest into Derrymacrow Lough. This lough subsequently drains to the west into Upper Lough Erne (ULE). The hydrological regime at the site appears to be under natural control.

Lake substrate

The lake substrate is predominantly silty in the deeper water areas, which is consistent with the underlying geology and alluvial soils in the catchment. The substrate predominantly comprises root mass at water depths >75 cm in S1 and S2

(north / northeast). In the shallow water areas (0 – 100 cm) of S3 (west), the substrate is predominantly sandy, with occasional areas of root mass and silt.

Sediment load

There is some poaching of the lake shore, although its extent is minimised by the dense marginal vegetation. Evidence for effects of poaching and sediment loading is limited; the water clarity was clear and Z_s was 2.42 m.

Indicators of local distinctiveness

Sium latifolium is frequently encountered in Kilturk Lough's marginal emergent flora. It is listed as a "priority species" for Northern Ireland (www.habitas.org.uk, 2007). In both 1990 and 2006, *S. aloides* was recorded growing in Kilturk Lough at low abundance. In 2014 however, its abundance increased to a '3' on a 1-3 scale and is the dominant species for S1 and S2. There is some debate (Preston and Croft 1997, Forbes 2000) as to whether *S. aloides* should be classified as an 'introduced' species in NI. It is doubtful however whether *S. aloides* should be considered a 'negative indicator species' and its population 'explosion' can most likely be attributed to the very warm summer of 2014 and the clear water observed in the lake (Forbes 2000).

Summary

Kilturk Lough does not achieve its macrophyte species compositional targets as only three characteristic species were recorded in the summer of 2014. In addition, three species were not recorded in 2014 which appeared in the 2006 survey: *Chara virgata, Potamogeton crispus* and *Potamogeton obtusifolius.* The abundance of *E. canadensis* has decreased by 17% since the last survey in 2006, which places it the range acceptable for favourable condition under the guidelines laid down within the CSM guidelines (JNCC 2015).

The abundance of the broadleaved *Potamogeton* species, *P. perfoliatus,* may have decreased – its abundance across the survey sections was very low in 2014, whereas it was classified as abundant ('4' on a scale of 1-5) in 1990. Also of possible concern is the absence of *L. uniflora* from the 2006 and 2014 surveys and the appearance (albeit at low abundance) of *P. pectinatus*. These observations are consistent with eutrophication at the site as is the population 'explosion' of *S. aloides.*

Diffuse pollution from surrounding farmland and settlements within the catchment may be contributing to the lough's high trophic status. Diffuse sources of pollution should be investigated and monitored to ensure that the lough's condition does not deteriorate further.

Table 319 Kilturk Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Kilturk Lough NI Lake 922	**Unfavourable**	Only three characteristic species recorded; High mean annual TP concentration (147 μgl^{-1}); Loss of characteristic species; Possible loss of *L. uniflora* since 1990; Decline of *P. perfoliatus* since 1990.	Although still relatively species rich, the site appears to have declined further since 2006. Abundance of *E. canadensis* is of concern and the spread of *S. aloides* is likely to be due to eutrophication. .

Species list

Table 320 List of all plant species recorded at Kilturk Lough

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Alnus glutinosa	R
Angelica sylvestris	R
Apium nodiflorum	R
Bidens cernua	R
Bidens tripartita	R
Butomus umbellatus	R
Caltha palustris	R
Carex remota	R
Carex rostrata	R
Carex sp.	R
Cicuta virosa	R
Epilobium hirsutum	R
Equisetum fluviatile	R
Filipendula ulmaria	R
Galium palustre	R
Hydrocotyle vulgaris	R
Iris pseudacorus	R
Juncus acutiflorus	R
Juncus effusus	R
Juncus inflexus	R
Lycopus europaeus	R
Lysimachia nummularia	R
Lysimachia vulgaris	R
Lythrum salicaria	R
Mentha aquatica	R
Menyanthes trifoliata	R
Myosotis scorpioides	R
Persicaria amphibia	R
Phalaris arundinacea	R
Phragmites australis	F
Potentilla palustris	R
Ranunculus flammula	R
Ranunculus lingua	R
Rorippa amphibia	R
Rumex hydrolapathum	R
Salix sp.	R
Schoenoplectus lacustris	O
Scutellaria galericulata	R
Senecio aquaticus	R
Sium latifolium	R

Marginal & Emergent species	Abundance (DAFOR)
Sparganium erectum	R
Stellaria graminea	R
Typha latifolia	R
Submerged & floating species	**% Frequency (n = 86)**
Elodea canadensis	42
Fontinalis antipyretica	10
Hydrocharis morsus-ranae	7
Lemna minor	28
Lemna trisulca	86
Menyanthes trifoliata	3
Nuphar lutea	45
Nymphaea alba	5
Potamogeton pectinatus	3
Potamogeton perfoliatus	1
Potamogeton pusillus	12
Ranunculus aquatilis	1
Sagittaria sagittifolia	13
Spirodela polyrhiza	47
Stratiotes aloides	65
Sparganium emersum	+

Survey data

Site Condition Assessment: Kilturk Lough (26/07/2014)

Lake Details		Survey Details		
Lake Name	Kilturk Lough	Survey Date	26/07/2014	
SSSI Name		Surveyors	SG, SD	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H372258	Wader Surveys	3	3
WBID / NI No.	50023 / 922	Boat Surveys	2	sections

Site

Survey
Boat survey not done for S1 due to extensive water Soldier growth. S1 25-50cm accessed from behind the phrag bed. Margins accessed from behind Phragmites bed.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	-
	Lateral distance from waters edge to 75cm depth (m)	50 m
	Notes: Difficult to access 25-30cm due todenseplantgrowth	
Section 2	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	4 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes: Zebra mussel present	
Section 3	Maximum depth of colonisation (cm)	310 cm
	Compass bearing of boat transect (°)	245 °
	Lateral distance from waters edge to 75cm depth (m)	8 m
	Notes:	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end
Section 1	H3764625510	H3771825586	-	-
Section 2	H3675026428	H3665026458	H3664426286	H3670126400
Section 3	H3682526128	H3687926045	H3686426084	H3692826103

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0065	0066	-
Section 2	107-0058	107-0059	107-0060
Section 3	0061	0062	0063

3.63. Friars Lough (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	27 July 2014
NI Lake Number:	929
WBID:	50141
County:	Fermanagh
Grid reference:	H369270
OS Grid reference (X,Y):	236867,326997
Shoreline development index:	1.304
Surface area (ha.):	10
Maximum recorded depth (m):	2.4

Table 321 Condition Assessment Summary Table for Friars Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species, and 1 broad-leaved *Potamogeton* spp.	**X**	4 characteristic species present in 2014: *Hydrocharis morsus-ranae, Spirodella polyrhiza* and *Potamogeton obtusifolius* as well as 1 broad-leaved *Potamogeton* spp. – *P. praelongus*.

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	*P. crispus, P. perfoliatus, Stratiotes aloides* and *Chara* spp. recorded in 1988, but not in 2014. 2 additional *Hydrochariton* spp. in 2014: *H. morsus-ranae* and *S. polyrhiza*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic spp.	✓	62% of vegetated sample spots comply (81% wader, 31% boat)
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 14% of vegetated, submerged sample points. In 1988 the abundance of *E. canadensis* was high ('4' on a 1-5 scale).
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	**X**	Borderline unfavourable – 20% of all points have a cover value of '3'.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Excellent marginal habitat dominated by broadleaf woodland, reeds and herbs. Entire site fringed by *P. australis*, with *S. lacustris* & *E. fluviatile* and some *T. latifolia* (25 - >75 cm). Species rich margins. mosaic structure to submerged and floating leaved flora: *Nuphar lutea frequent* in open waters (25-215 cm) intermingled by *L. minor, L. trisulca* and *S. polyrhiza. Sparganium emersum* frequent in deeper water (120-215 cm). *H. morus-ranae* occasional S1&3. Other submerged flora recorded less frequently: *P. praelongus* (S1&3), *P. obtusifolius* (S1&3), *P. pusillus* (S3) and *Nitella mucronata* (S1&3 at ~170 cm). *E. canadensis* recorded occasionally in all sections (50– >75 cm).
	Maximum depth distribution should be maintained	**X**	Z_{max} (recorded) = 2.4 m, Z_s = 0.82 m, Z_v = 2.15 m. Water turbid
	At least the present structure should be maintained	✓	Hydrosere present – no change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 217 μgl^{-1} (range = 102-461) & TN = 1.71 mgl^{-1} (April '14 – Feb. '15)

Attribute	Target	Status	Comment
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.7 (range = 7.8 – 8.2)
	Adequate dissolved O_2 throughout the water column (mean > 6mgl^{-1} below thermocline)	**X**	Water column is well mixed throughout; mean reading of DO = 4.96 mgl^{-1}.
	No excessive growth of cyanobacteria or green algae	**X?**	Severe blue-green bloom & turbid water during April '14 water sampling. No blue-green bloom during plant survey but water turbid throughout lough.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Appears natural.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of change. Pasture surrounds the lough but no evidence of poaching.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	**-**	None noted
	Minimal negative impacts and no fish farming	✓	Shore angling but no evidence for negative impacts. Grazing all year long but no poaching observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 10 ha, with no loss of extent of open water.

Macrophyte community composition

Friars Lough has a moderately rich submerged and floating leaved aquatic macrophyte flora (14 species), although only has four characteristic species. The site does have a rich marginal and emergent flora however. The total number of species recorded at the site in 2014 was 42. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.1 and 7.07 respectively (Table 322). This is very similar to the TRS and PLEX scores of 1988 (when they were 8.3 and 7.39 respectively) suggesting that the trophic status of the lake has remained relatively stable. Four submerged/floating-leaved taxa that were recorded in 1988 were absent from the 2014 survey: *P. crispus, P. perfoliatus, Stratiotes aloides* and *Chara* spp., the first two of which were recorded in high abundance. However, two additional species were gained since 1988; *H. morsus-ranae* and *S. polyrhiza.* The overall confidence in changes to the characteristic species between the 1988 and 2014 surveys is reduced somewhat by different methods being employed which produce data that are directly comparable. Although lacking in total number, the characteristic that were present had good coverage within the lough with 62% of the sample plots having at least one.

Table 322 Aquatic macrophyte community composition for Friars Lough, including trophic scores.

	1988 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=94)***
Elodea canadensis	8.5	7.95	4	8.5	7.95	13.8
Fontinalis antipyretica	6.3	5.38	2	6.3	5.38	1.1
Hydrocharis morsus-ranae	**-**	**-**	**-**	**-**	**-**	**26.6**
Lemna minor	9.0	8.85	1	9.0	8.85	73.4
Lemna trisulca	10.0	8.85	5	10.0	8.85	44.7
Nitella mucronata	-	-	-	5.5	5.38	2.1
Nuphar lutea	8.5	6.92	5	8.5	6.92	85.1
Potamogeton crispus	**8.5**	**7.95**	**4**	**-**	**-**	**-**
Potamogeton obtusifolius	**7.3**	**6.54**	**2**	**7.3**	**6.54**	**4.3**
Potamogeton perfoliatus	**7.3**	**7.69**	**5**	**-**	**-**	**-**
Potamogeton praelongus	**7.3**	**5.38**	**1**	**7.3**	**5.38**	**6.4**
Potamogeton pusillus	8.5	7.95	2	8.5	7.95	1.1
Sparganium emersum	10.0	7.5	4	10.0	7.5	27.7
Spirodela polyrhiza	**-**	**-**	**-**	**-**	**-**	**55.3**
Stratiotes aloides	-	-	1	-	-	-
***Chara* spp.**	**8.5**	**7.69**	**2**	**-**	**-**	**-**
Average score	**8.3**	**7.39**		**8.1**	**7.07**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was recorded as abundant in 1988 ("4" on a 1-5 abundance scale) and in 2014 it was recorded at an overall frequency of 14%, suggesting that although *E. canadensis* has been a substantial component of Friar's Lough's aquatic macrophyte community for at least the last 26 years, its population is significantly decreasing. Although declining, the persistent present of this non-native species is unfavourable.

Macrophyte community structure

Friars Lough is bound by pasture all around, with a thin strip of broadleaf woodland to the northeast. A blanket bog fringes the lough to the southwest. Beyond this zone, the lough has excellent marginal habitat, dominated by reeds and herbs. A good example of a *Scirpo-Phragmitetum* community fringes the entire lough, consisting predominantly of *Phragmites australis*, *Schoenoplectus lacustris, Equisetum fluviatile* and some *Typha latifolia,* extending out to approximately >75 cm. A number of other emergent plants are also abundant within the margins, including *Cicuta virosa, Iris pseudacorus, Menyanthes trifoliata* and *Senecio aquaticus.* The open

water submerged and floating leaved aquatic macrophyte flora showed some degree of zonation: *Nuphar lutea* was frequently recorded, extending out to a maximum depth of 215 cm, intermingled by *Lemna minor, Lemna trisulca* and *Spirodella polyrhiza. Sparganium emersum* was frequently encountered in the deeper waters of 120 – 215 cm, while *Hydrocharis morsus-ranae* was recorded with an occasional abundance to the northwest and southeast of the lough. Rarely found were species *Potamogeton praelongus* (S1 and S3 between 130 – 165 cm), *Potamogeton obtusifolius* (S1 and S3, at >75 cm and once at 160 cm), *Potamogeton pusillus* (S3 only at >75 cm) and *Nitella mucronata* (S1 and S3, at approximately 170 cm). *Elodea canadensis* grew throughout the lough but only generated an abundance of 1 (on a 1-5 scale). It was typically found growing in the shallower waters of 50 - >75 cm. *Oenanthe aquatica* was also recorded in S1 at >75 cm. A full species list is given in Table 325 below.

Water quality

Table 323 Water chemistry data for Friars Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	1988
TP	461	102	184	120	**216.6**	32
SRP	48	44	126	86	**76**	1
TN	2.59	0.94	1.97	1.35	**1.71**	1.21
TON	0.063	0.005	0.489	0.448	**0.251**	-
Nitrite	0.005	0.001	0.016	0.005	**0.007**	-
Chl *a*	104.3	1.5	5.6	3.9	**28.82**	20.6
DOC	10.8	12.4	15.6	11	**12.45**	-
pH	7.58	8.15	7.55	7.66	**7.74**	7.49
Alk	143	180	141	133	**149.3**	124
Cond	308	320	317	293	**309.5**	269
Ca^{2+}	57.6	57.9	53.6	49.2	**54.6**	44
Mg^{2+}	4.47	4.55	4.68	3.93	**4.41**	3.65
Na^{+}	8.1	8.13	8.93	9.33	**8.62**	7.1
K^{+}	3.89	3.37	4.78	3.79	**3.96**	1.15
Cl^{-}	12.9	11.3	14	17.1	**13.83**	15
SO_4^{2-}	13.5	7.95	24.2	13.6	**14.81**	12.8

Friars Lough is a very shallow (Z_{max} recorded = 2.4 m), high alkalinity, hyper-eutrophic lake with a very high annual mean TP (216 $\mu g l^{-1}$) which classifies it as "unfavourable" with respect to trophic status. Chl *a* was particularly high in April 2014, when a severe blue-green algal bloom was observed. Given the strong positive correlation in the Friars Lough data between TP and Chl *a,* there is a possibility that an influx of nutrients to the lake was the cause of the algal boom. TP concentration decreased significantly over the subsequent seasonal water sample visits, although they are still above the target concentration of 50 $\mu g l^{-1}$.In summer 1988, a spot water sample recorded a TP concentration of 32 $\mu g l^{-1}$. Although no firm conclusions can be drawn from these two sets of independent data, TP concentrations between 1988 and 2014 appear to have increased, suggesting a

higher, less favourable trophic status in 2014 than in 1988. At the time of survey in July 2014, the upper 1.5 m of the water column was sufficiently mixed and oxygenated (5.4 – 6.21 mgl^{-1}), although the mean value of readings throughout the water column falls below the GES standards (4.96 mgl^{-1}), as referenced in the CSM for 2015 (JNCC 2015) (Figure 65).

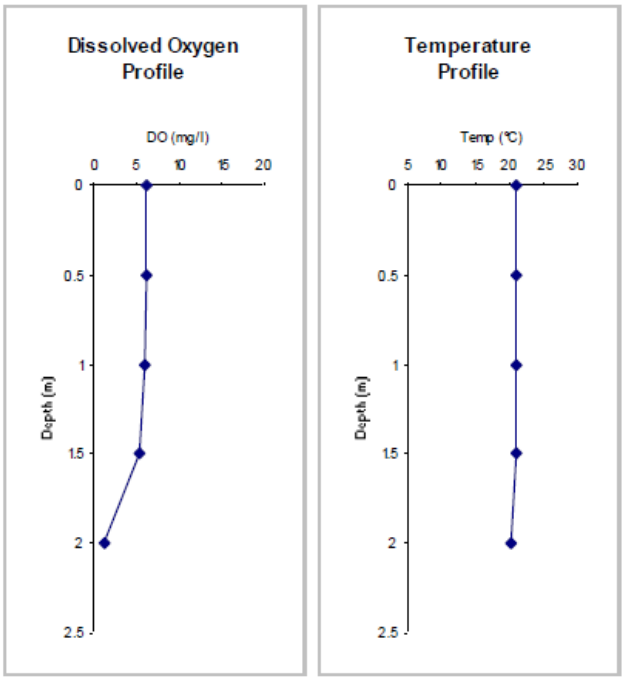
Figure 65 Dissolved oxygen and temperature profile for Friars Lough (27/07/2014)

Dissolved Oxygen Profile

GPS Location	H3687927035
Maximum Depth (m)	2.4 m
Secchi Depth (cm)	82 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	6.21	21
0.5	6.09	21
1	5.91	21
1.5	5.4	20.9
2	1.2	20.1



Hydrology

Friars Lough is in very close proximity to Upper Lough Erne and hydrologically connected via a series of small streams and loughs. The outflow is located to the southeast of the lough, feeding directly into Sand Lough. Another stream is located on the north shore, which connects Friars Lough to Clonmin Lough. The hydrological regime at the site appears natural.

Lake substrate

In the shallower water areas of all sections, root mass predominates to water depths of 75 cm. The lake substrate is predominantly silty at water depths >75 cm.

Sediment load

Much of the lough is surrounded by a reed and sedge dominated wetland fringe, with some areas of floating bog, which will serve to reduce the impact of any increase in sediment loads. At the time of survey, grazing was only observed in the pasture fields to the northwest of the lough and there were no signs of poaching. No evidence of an increased sediment load was observed.

Indicators of local distinctiveness

None noted.

Summary

Friars Lough supports a moderately species rich submerged, floating-leaved and marginal aquatic macrophyte flora and the frequency of characteristic species across both the wader and boat transects (62%) meets the species frequency target of >60% of sample spots having one or more characteristic species. However, only four characteristic species, including two *Potamogeton* spp. were recorded overall, which fails to reach the CSM target of ≥6 characteristic species including one broadleaved *Magnopotamion* species. Four characteristic species have been lost since the NILS 1988 survey (*P. crispus, P. perfoliatus, Stratiotes aloides* and *Chara* spp), while two have been gained since (*H. morsus-ranae and S. polyrhiza*) resulting in a net loss of characteristic species. It must be remembered however that the survey methods used in 1988 and 2014 do not produce data that are directly comparable.

The frequency of *E. canadensis* has decreased significantly over the past 26 years (14% frequency), but the sustained presence of this non-native species is nonetheless unfavourable.

The water quality data (although the 1988 data is based only on a summer spot sample), suggests a decline in trophic state, with significantly higher TP and Chl *a* concentrations (but similar TN concentrations) recorded in 2014 than in 1988. The positive relationship between TP and Chl *a* suggests a possible influx in nutrients to the lough resulting in a severe algal bloom. Therefore, the current water quality and macrophyte community composition places the lough in **unfavourable** condition, with elevated nutrient concentrations and high algal turbidity posing a significant risk to the lough's ecological status.

Table 324 Friars Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Friars Lough NI Lake 1017	Unfavourable	High trophic status Low number of characteristic species Cyanobacterial blooms present *Elodea canadensis* present.	Moderately species rich with fairly good coverage of characteristic species across wader and boat transects. Frequency of *E. canadensis* decreased since 1988. Diffuse pollution likely to be the primary reason for long-term decline.

Species list

Table 325 List of all plant species recorded at Friars Lough

Marginal & Emergent species	Abundance (DAFOR)
Alnus glutinosa	R
Angelica sylvestris	R
Apium nodiflorum	R
Carex paniculata	R
Cicuta virosa	R
Epilobium hirsutum	R
Epilobium palustre	R
Equisetum fluviatile	O
Eupatorium cannabinum	R
Filipendula ulmaria	R
Galium palustre	R
Iris pseudacorus	R
Juncus effusus	R
Lycopus europaeus	R
Lysimachia vulgaris	R
Lythrum salicaria	R
Mentha aquatica	O
Menyanthes trifoliata	R
Myosotis scorpioides	R
Phalaris arundinacea	R
Phragmites australis	F
Potentilla palustris	R
Rumex hydrolapathum	R
Salix sp.	R
Senecio aquaticus	R
Sparganium erectum	R
Typha latifolia	R

Submerged & floating species	% Frequency (n = 94)
Elodea canadensis	14
Fontinalis antipyretica	1
Hydrocharis morsus-ranae	27
Lemna minor	73
Lemna trisulca	45
Nitella mucronata	2
Nuphar lutea	85
Potamogeton obtusifolius	4
Potamogeton praelongus	6
Potamogeton pusillus	1
Sparganium emersum	28
Sparganium erectum	2
Spirodela polyrhiza	55

Survey data

Site Condition Assessment: Friars Lough (27/07/2014)

Lake Details		Survey Details		
Lake Name	Friars Lough	Survey Date	27/07/2014	
SSSI Name		Surveyors	SG, SD	
SAC Name		Shore Surveys	3	out of
Grid Ref (centre)	H369270	Wader Surveys	3	3
WBID / NI No.	50141 / 929	Boat Surveys	3	sections

Site Survey

Section Summaries

Section 1

Maximum depth of colonisation (cm)	215 cm
Compass bearing of boat transect (°)	298 °
Lateral distance from waters edge to 75cm depth (m)	10 m

Notes:

Section 2

Maximum depth of colonisation (cm)	215 cm
Compass bearing of boat transect (°)	210 °
Lateral distance from waters edge to 75cm depth (m)	1.5 m

Notes: Good species rich margins at sub-section 1 and 5

Section 3

Maximum depth of colonisation (cm)	-
Compass bearing of boat transect (°)	-
Lateral distance from waters edge to 75cm depth (m)	15 m

Notes: No end to plants on boat survey

Section Locations

	Shore Survey GPS Co-ords start	Shore Survey GPS Co-ords end	Boat Survey GPS Co-ords start (shore)	Boat Survey GPS Co-ords end
Section 1	H3671927039	H3667027138	H3668827084	H3686227057
Section 2	H3693726875	H3684926936	-	H3691726920
Section 3	H3714826843	H3707726910	H3712226883	H3708426851

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0067	0068	0073
Section 2	0075	0076	0077
Section 3	0079	0081	0080

3.64. Knockballymore A Lough (HA VSh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

Survey Date	06 July 2014
NI Lake Number:	949
WBID:	50385
County:	Fermanagh
Grid reference:	H476268
OS Grid reference (X,Y):	247672,326801
Shoreline development index:	1.105
Surface area (ha.):	2.0
Maximum recorded depth (m):	13.0

Table 326 Condition Assessment Summary Table for Knockballymore A Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	✓	4 *Chara* species in total. *Chara aculeolata* & *C. hispida* present within sections. 2 other species recorded outside the survey points: *C. vulgaris var papillata* and *C. contraria var hispidula.*
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	6% of vegetated sample spots comply.
	Negative indicator species absent or at low frequency	✓	*Elodea canadensis* present at 13% of sample sites.

Attribute	Target	Status	Comment
Negative indicator species	Non-native species absent or present at low frequency	**X**	Persistent *Elodea canadensis* population at the site, present at 13% of sample sites.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	Filamentous algae present at low levels. No points scored '3'
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone	**X**	Excellent wetland flora to east of site. Reed fringed with *P. australis* and *S. lacustris* dominating. *N. lutea* grows up to depths of 3.2 m, *Lemna trisulca* (< 1.5 m) and *P. lucens*. (1.0 – 2.5 m), *P. alpinus* (1.9 – 2.8 m). *Chara hispida and C. aculeolata* present in <50cm depth at 6% of sample sites. No extensive Chara beds present.
	Maximum depth distribution should be maintained	**X**	Z_{max} = 13.0 m, Z_{s} = 2.75 m, Z_{v} = 3.2 m (reduction in Z_{v} since 2006)
	At least the present structure should be maintained	**X**	Charophytes recorded in 1988, not in 2006 but have been observed in recent survey at only low abundance.
Water quality	Stable nutrients levels: TP target / limit = 15 μgl^{-1}	**X**	TP = 26.2 μgl^{-1} (12.1 – 53.7 μgl^{-1}) & TN = 0.7 mgl^{-1} (April '14 – Feb '15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.1 (range = 7.9 – 8.3)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	**X**	Waters were well oxygenated to 4.0 m (> 5.0 mgl^{-1}), below which levels rapidly dropped off to a mean value of 0.33 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial or surface algal blooms.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	Catchment land cover is mainly rough pasture, but there was no evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	✓	Charophytes not recorded in 2006 but have been observed in recent survey.
	Minimal negative impacts	✓	Moderate grazing pressure from cattle and slight poaching.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 2.0 ha, with no loss of extent of open water.

Macrophyte community composition

Two species of charophyte were recorded in the recent survey of Knockballymore A, *Chara aculeolata* and *C. hispida*. Two additional species were also casually recorded at the launch point, C. vulgaris var papillata and C. contraria var hispidula. However, *Chara* beds only cover 7.35% of the surveyed area and recorded as 'rare' on the DAFOR scale. *Myriophyllum spicatum* and *Potamogeton crispus* were also notes as present at the site, but not within the survey sections..

The NI lake survey recorded charophytes as being frequent ("3" on a 1-5 scale) in August 1988, yet none were found during the 2006 survey. Notably absent from the 2014 survey were *Potamogeton natans, Sparganium natans* and *Utricularia australis*. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.1 and 6.93 respectively (Table 327), which are similar to the 1988 TRS and PLEX scores of 8.0 and 6.74. The lower scores from the 2006 survey were as a result of *S. natans* and *U. australis* being present.

Table 327 Aquatic macrophyte community composition for Knockballymore A Lough, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=58)***	**TRS**	**PLEX**	**% occurrence (n=68)***
Chara aculeolata	**-**	**-**	**-**	**8.5**	**7.69**	**5.88**
Chara hispida	**-**	**-**	**-**	**8.5**	**7.69**	**1.47**
C. vulgaris var papillata	**-**	**-**	**-**	**8.5**	**7.69**	**+**
C. contraria var hispidula.	**-**	**-**	**-**	**8.5**	**7.69**	**+**
Elodea canadensis	8.5	7.95	48	8.5	7.95	13.24
Fontinalis antipyretica	6.3	5.38	22	6.3	5.38	10.29
Lemna minor	9.0	8.85	2	-	-	-
Lemna trisulca	10.0	8.85	74	10.0	8.85	58.82
Menyanthes trifoliata	-	-	7	-	-	8.82
Nuphar lutea	8.5	6.92	71	8.5	6.92	75.00
Nymphaea alba	6.7	3.08	21	6.7	3.08	2.94
Potamogeton alpinus	5.5	5.38	2	5.5	5.38	16.18
Potamogeton lucens	10.0	7.88	16	10.0	7.88	2.94
Potamogeton natans	6.7	4.23	+	-	-	-
Sparganium natans	5.5	3.08	12	-	-	-
Utricularia australis	5.5	4.23	3	-	-	-
Average score	**7.5**	**5.98**		**8.1**	**6.93**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys. A plus (+) denotes species recorded outside of the survey section

Negative indicator species

Elodea canadensis was found at 13.2% frequency and occasional abundance (median value of "2" on a 1-5 scale). It was recorded with a 48% frequency in 2006, so the abundance of *E. canadensis* has decreased since the previous field visit, but this is a dynamic species and its presence in unfavourable. No other negative indicators were found.

Macrophyte community structure

Knockballymore A Lough is bordered by reed beds that are dominated by *P. australis* and *S. lacustris*, with rough and semi-improved pasture around the much of the shore. To the east of the site, there is an extensive area of alkaline fen which extends to the middle lough in this chain of three loughs. Beyond the fringing reeds, *N. lutea* dominates, growing in a ring around much of the site, growing up to depths of 3.0 m, with the occasional occurrence of *Nymphaea alba* (>0.75 m). It is of concern that the maximum depth of *N. lutea* was recorded as 4.0 m in 2006, suggesting the maximum depth of colonisation for plants has decreased. *Potamogeton lucens* was recorded far less than the previous survey in 2006, appearing only once on the boat survey and once on the wader survey in Section 2, up to a depth of 2.3m. By comparison, *P. alpinus* was recorded as 'frequent' with an abundance of "3". Charophytes were present in up to 0.5 m depth, but were recorded intermittently, with an abundance of "1" and classified as "rare". The site lacks the extensive beds of *Chara* spp. expected for this lake types and is therefore unfavourable with respect to structure.

Water quality

Table 328 Water chemistry data for Knockballymore A Lough

	Apr. '14	Aug '14	Nov' 14	Feb '15	Mean	2006	1988
TP	18.9	12.1	53.7	20.1	**26.2**	28	14
SRP	2.0	1.0	3.0	6.0	**3.0**	-	1
TN	0.58	0.48	0.82	0.87	**0.7**	0.7	0.81
TON	0.018	0.005	0.016	0.336	**0.094**	-	-
Nitrite	0.002	0.001	0.003	0.004	**0.002**	-	-
Chl a	6.27	2.04	6.27	2.64	**4.31**	7.5	3
DOC	5.93	5.74	5.44	6.86	**6.0**	-	-
pH	8.21	8.15	7.94	8.27	**8.1**	8	8.02
Alk	174	173	170	176	**173.3**	172.8	100
Cond	346	343	340	336	**341.3**	359	358
Ca2+	68.3	67.3	66	62.9	**66.1**	41.9	48.8
Mg2+	4.0	4.04	3.85	3.8	**3.9**	3.6	3.25
Na+	6.67	6.87	6.35	6.62	**6.6**	6	5.35
K+	3.42	3.27	3.49	3.49	**3.4**	4	1.95
Cl-	11.6	11.1	11.6	11.8	**11.5**	8.4	13.5
SO42-	<10	7.98	8.19	10.1	**<9.1**	11.9	11.2

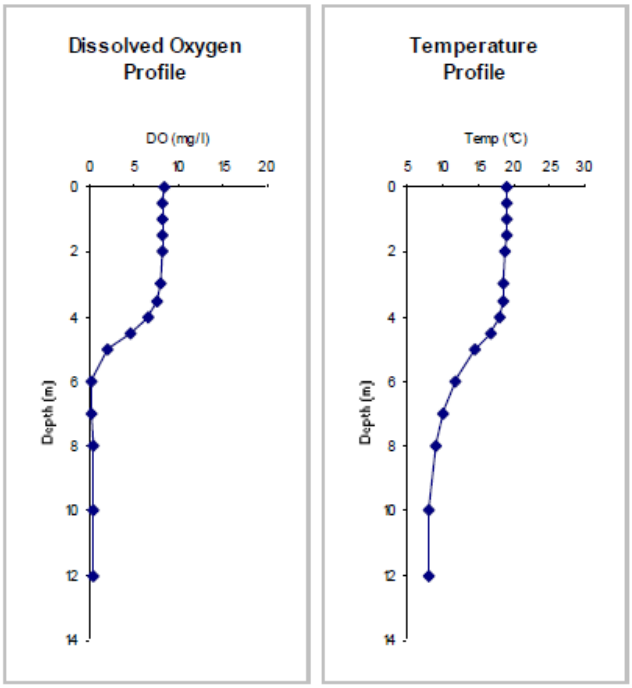
The water chemistry of Knockballymore A Lough is typical of hard oligo-mesotrophic lakes and ponds, having base-rich water. Total phosphorus is above the limit set out in the CSM guidelines for this lake type however (15 μgl^{-1} JNCC 2015) and has remained very similar to the mean value recorded in 2006 (28.0 μgl^{-1}). The TP concentration recorded from a spot water sample taken on the 02/08/1988, although low, was in fact very similar to the August 2014 value (Table 328) and therefore no trends can be determined. The upper 4.0 m of the water column was well oxygenated (> 6.66 mgl^{-1}), rapidly declining to a mean value of 0.33 mgl^{-1} below the thermocline (Figure 66). The current water quality is unfavourable within the guidelines (JNCC 2015).

Figure 66 Dissolved oxygen and temperature profile for Knockballymore A Lough (06/07/2006)

Dissolved Oxygen Profile

GPS Location	H4767426796
Maximum Depth (m)	13 m
Secchi Depth (cm)	2.75 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.33	19.1
0.5	8.28	19
1	8.27	18.9
1.5	8.24	18.9
2	8.19	18.8
3	7.92	18.5
3.5	7.53	18.4
4	6.66	17.9
4.5	4.68	16.7
5	1.99	14.5
6	0.26	11.7
7	0.29	9.9
8	0.32	9
10	0.38	8.1
12	0.4	8



Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty with marginal substrates mainly comprising root mass.

Sediment load

The dominant land cover in the catchment is rough pasture and though there is moderate grazing pressure and slight poaching from cattle, the disturbance appears to be relatively low. No evidence of increased sediment loads to the lough was noted from the catchment.

Indicators of local distinctiveness

Two species of charophyte were recorded on the survey: *C. hispida* and *C. aculeolata.* However, they were not recorded in abundance and only at the margin within a depth less than 0.5 m. Their frequency totalled 7.35%, both with a DAFOR score of "1", classifying the genus as "rare" in Knockballymore A. Two additional species were noted at the site of launch but not included in the survey: *C. vulgaris var papillata* and *C. contraria var hispidula.* Charophytes were not recorded in the 2006 survey.

Summary

Knockballymore A Lough is classed as being in **unfavourable** condition**.** The characteristic charophyte flora appears to have declined significantly since the 1988 survey (NILS) when they were recorded as "frequent". In 2006 none were found, whereas in 2014, four species were present, but at very low abundance and coverage. The water chemistry was typical of the lake type, but total phosphorus was above the limit set out in the CSM guidelines with no evidence of significant change since 2006.

The clarity at the site was good with very low levels of filamentous algal growth. The frequency of *E. canadensis* and *F. antipyretica* has declined since the 2006, which coupled with the more recent *Chara* spp. records, represents a slight improvement since the previous survey. Conversely, although water clarity was good, the maximum depth of colonisation has fallen since 2006 which may indicate that there have been periods of higher turbidity at the site.

Dissolved oxygen values were on average < 7 mgl^{-1} beneath the thermocline. There is moderate grazing pressure and slight cattle poaching, but no evidence of increased sediment loading to the lough was observed. Less intensive agriculture around the shore and within the catchment would be beneficial and it is recommended that catchment sources of nutrients are investigated. Angling was observed in 2006, but there is no evidence to suggest the site is regularly fished and any impacts are currently unknown.

Table 329 Knockballymore A Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Knockballymore A Lough NI Lake 949	Unfavourable	Charophytes have minimal coverage within vegetative zones; TP values exceed recommended CSM 2015 levels; DO is < 7 mgl^{-1} below thermocline.	Site has good marginal vegetation. Four species of charophytes present, recorded as absent in 2006 survey. *E. canadensis* frequency has decreased by 35% since 2006. Investigate and prevent nutrient inputs to the site.

Species list

Table 330 List of all plant species recorded at Knockballymore A Lough: 2015

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	F
Alisma plantago-aquatica	R
Angelica sylvestris	R
Caltha palustris	R
Carex acutiformis	F
Carex diandra	R
Carex elata	R
Carex rostrata	F
Cicuta virosa	O
Cirsium palustre	R
Cladium mariscus	F
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum fluviatile	O
Eriophorum angustifolium	R
Filipendula ulmaria	R
Galium palustre	O
Hippuris vulgaris	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Lysimachia nummularia	R
Lysimachia vulgaris	R
Lythrum salicaria	R
Mentha aquatica	O
Menyanthes trifoliata	F
Myosotis scorpioides	R
Phragmites australis	A
Potentilla palustris	R
Schoenoplectus lacustris	A
Scutellaria galericulata	R
Typha latifolia	R
Valeriana officinalis	R
Veronica scutellata	R
Submerged & floating species	**% Frequency (n = 57)**
Chara aculeolata	6
Chara hispida	1
Elodea canadensis	13
Fontinalis antipyretica	10
Lemna minor	+
Lemna trisulca	59
Myriophyllum spicatum	+
Nuphar lutea	75
Nymphaea alba	3
Potamogeton alpinus	16
Potamogeton crispus	+
Potamogeton lucens	3

Survey data

Site Condition Assessment: Knockballymore (A) (06/07/2014)

Lake Details		**Survey Details**		
Lake Name	Knockballymore (A)	Survey Date	06/07/2014	
SSSI Name		Surveyors	SG, EA, BG	
SAC Name	Magheraveely Marl Lakes	Shore Surveys	2	out of
Grid Ref (centre)	H476268	Wader Surveys	2	2
WBID / NI No.	0 / 949	Boat Surveys	2	sections

Site
Alisma p.a. on site. Pot. nat. - not in survey. S1 marginals point @ not.

Survey
Site looking good. M. spic and Pot. Crisp at launch

H4780526796 and Chara hispida, Chara vulgaris var papillata and Chara contraria var hispidula

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	320 cm
		Compass bearing of boat transect (°)	10 °
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	180 cm
		Compass bearing of boat transect (°)	300 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end
Section	**1**	H4777526859	H4770826866	H4774026882	H4774526872
Section	**2**	H4755226765	H4762826719	H4759526722	H4760626729

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0024	0025	0026
Section	**2**	0027	0029	0030

3.65. Knockballymore B Lough (HA Sh)

Annex 1 type: H3140: Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Survey Date	06 July 2014
NI Lake Number:	950
WBID:	50385
County:	Fermanagh
Grid reference:	H477268
OS Grid reference (X,Y):	200477,300268
Shoreline development index:	1.105
Surface area (ha.):	0.5
Maximum recorded depth (m):	6.6

Table 331 Condition Assessment Summary Table for Knockballymore B Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	At least 1 characteristic *Chara* species should be present (excluding *C. vulgaris*)	**X**	None present.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X**	0% of vegetated sample spots comply.
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present at 32% of sample sites.
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 32% of sample sites.

Attribute	Target	Status	Comment
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	Filamentous and benthic algal cover was low; no sampling points had a cover value of '3'.
Macrophyte community structure	Characteristic vegetation zones should be present and *Chara* beds should cover > 50 % of photic zone (see Table 5)	**X**	Varied, but species rich emergent zones (*P. australis, S. lacustris, Carex* spp., and *Menyanthes trifoliata*). Steeply shelving banks fringed with *N. lutea* up to 2.5 m and *U. australis* (-.25 – 1 m). No charophytes present.
	Maximum depth distribution should be maintained	✓	Z_{max} = 6.6 m, Z_s = 1.9 m, Z_v = 2.3 m
	At least the present structure should be maintained	✓?	No change evident, remains unfavourable.
Water quality	Stable nutrients levels: TP target / limit = 15 μgl^{-1}	**X**	TP = 21.4 μgl^{-1} (range 11.6 – 38.8 μgl^{-1}) & TN = 0.52 mgl^{-1} (April'14 – Feb'15)
	Stable pH values: pH ~ 7.0 – 8.50	✓	pH = 8.0 (range = 7.9 – 8.1)
	Adequate dissolved O_2 throughout the water column (mean > 7 mgl^{-1} below thermocline)	-	Dissolved O_2 readings unavailable due to a technical fault in the field.
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacterial or surface algal blooms.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained. Slight disturbance from cattle poaching.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	Dominant catchment land cover is rough pasture, but there was no evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained	**X**	Charophytes recorded in 1988 (NILS) but not observed in 2006 (CSM) or the recent survey.
	Minimal negative impacts	✓?	Moderate grazing pressure from cattle and slight poaching.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 0.5 ha, with no loss of extent of open water.

Macrophyte community composition

No charophytes were recorded from the 2014 or 2006 surveys in Knockballymore B Lough, despite them being recorded as being of 'frequent' in 1988 (NILS). The site is therefore classed as unfavourable with respect to the species assemblage. Two other species were absent from the 2014 survey but present in 2006 (CSM): *Nymphaea alba* and *Potamogeton lucens* and *Hippuris vulgaris* was recorded in 1988 but not in 2006 or 2014. All other species observed in 1988 and 2006 were also recorded in 2014. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.2 and 7.03 respectively (Table 332), which are similar to the 2006 scores and those calculated from the 1988 survey (8.3 and 7.01).

Table 332 Aquatic macrophyte community composition for Knockballymore B Lough, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=26)***	**TRS**	**PLEX**	**% occurrence (n=28)***
Elodea canadensis	8.5	7.95	19	8.5	7.95	32.1
Fontinalis antipyretica	-	-	-	6.3	5.38	3.6
Lemna minor	-	-	-	9.0	8.85	+
Lemna trisulca	10.0	8.85	54	10.5	8.85	50.0
Menyanthes trifoliata			19			28.6
Nuphar lutea	8.5	6.92	69	8.5	6.92	82.1
Nymphaea alba	6.7	3.08	+	-	-	-
Potamogeton lucens	10.0	7.88	15	-	-	-
Utricularia australis	5.5	4.23	27	5.5	4.23	28.6
Average score	**8.2**	**6.49**		**8.1**	**7.03**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was recorded at 32% frequency and occasional abundance (median value of "2" on a 1-5 scale). This is an increase from 19%, as recorded in 2006. It was not recorded in 1988, suggesting that it has colonised the site relatively recently which is unfavourable under CSM guidelines (JNCC 2015).

Macrophyte community structure

Knockballymore B Lough has a species rich emergent zone dominated by *Phragmites australis, Carex* spp. and *Schoenoplectus lacustris*, with rough pasture beyond and areas of extensive wetland extending between the other two loughs in the Knockballymore chain. *Menyanthes trifoliata* and *Juncus acutiflorus* occur frequently with *Alnus* spp. prevalent along the north-west margins. In open water, *Nuphar lutea* fringes the lough, growing at water depths of up to 2.5 m, with *Menyanthes trifoliata* (0.25 – 0.75 m), *Utricularia australis* (0.25 – 1 m) and *Lemna*

trisulca (0.25 – 1.25 m). The site lacks *Chara* spp. and is therefore unfavourable with respect to structure. No charophytes were recorded.

Water quality

The water chemistry of Knockballymore B Lough is typical of hard oligo-mesotrophic lakes and ponds, having base-rich water and elevated ionic concentrations. Mean annual total phosphorus is however slightly above the level set out in the CSM guidelines for this lake type (15 μgl^{-1} JNCC 2015) at 21.4 μgl^{-1}, but has significantly decreased since 2006, when it was recorded to be 33.8 μgl^{-1}.

The water clarity was good during the summer survey and only low levels of filamentous algal were recorded. The water quality is unfavourable, but has improved since 2006 with respect to trophic status. No dissolved oxygen profile was recorded due to the meter being faulty.

Table 333 Water chemistry data for Knockballymore B Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '14	Mean	2006	1988
TP	20.9	14.2	38.8	11.6	21.4	34.0	15
SRP	2.1	1.0	4.8	6.7	3.7	-	1
TN	0.6	0.5	0.7	0.3	0.5	0.5	0.82
TON	0.005	0.005	0.009	0.085	0.026	-	-
Nitrite	0.001	0.001	0.001	0.002	0.001	-	-
Chl a	4.1	2.42	4.1	0.6	2.8	6.9	4.6
DOC	6.1	5.8	6.4	2.2	5.1	-	-
pH	8.1	8.1	7.9	8.1	8.0	7.8	8.01
Alk	175	176	172	42	141.3	149	201
Cond	340	345	334	107	281	334	363
Ca2+	67.0	64.8	63.3	15.9	52.8	63.4	69
Mg2+	3.8	3.9	3.8	1.0	3.1	2.8	3.55
Na+	6.5	6.3	6.3	2.9	5.5	7.0	5.35
K+	3.0	3.3	3.0	1.0	2.6	3.5	1.7
Cl-	11.1	11.4	11.0	5.2	9.7	8.4	12.9
SO42-	<10	7.9	6.1	2.3	6.6	11.4	11

Hydrology

The hydrological regime at the site appears natural.

Lake substrate

The lake basin is predominantly silty with marginal substrates comprising of organic sediments and root-mass in the reed beds.

Sediment load

The dominant land cover in the catchment is rough and semi-improved pasture and though there is moderate grazing pressure and slight poaching from cattle, the

disturbance appears to be relatively low. No evidence of increased sediment loads was noted from the catchment.

Indicators of local distinctiveness

Charophytes, a characteristic species of this lake type, were not observed in the current survey (or in 2006) despite being recorded in the 1988 survey.

Summary

The condition of Knockballymore B Lough is classified as **unfavourable** due to a complete lack of charophytes in the site in 2014 and 2006. This is a significant deterioration since the NILS surveys during which charophytes were recorded as 'frequent'. The water chemistry was typical of the lake type, though total phosphorus was above the level set out in the CSM guidelines and appeared to be higher than the TP concentration recorded in 1988, although the spot sample from August 1988 was in fact very similar to the 2014 value for August. The water clarity was good with low levels of filamentous algal growth. The increasing presence of *E. canadensis* (which was not recorded in the 1988 survey), is unfavourable and this species is likely to gain a competitive advantage with the observed nutrient enrichment. Potential nutrient sources, which are likely to be from diffuse agricultural and domestic sources, should be investigated and reduced where possible. At the time of survey there was moderate grazing pressure and slight cattle poaching, but no evidence of increased sediment loads to the lough were observed

Table 334 Knockballymore B Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Knockballymore B Lough NI Lake 950	Unfavourable	No charophytes present Loss of characteristic species since 1988 TP exceeds CSM target levels.	Site exhibiting symptoms of nutrient enrichment – investigate potential nutrient sources and manage appropriately. TP appear to have fallen since 2006.

Species list

Table 335 List of all plant species recorded at Knockballymore B Lough

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	R
Alnus glutinosa	F
Angelica sylvestris	R
Carex acutiformis	F
Carex diandra	O
Carex elata	F
Carex rostrata	O
Cicuta virosa	R
Cirsium palustre	R
Epilobium palustre	R
Equisetum fluviatile	O
Filipendula ulmaria	R
Galium palustre	O
Juncus acutiflorus	F
Juncus effusus	R
Lychnis flos-cuculi	R
Lysimachia nummularia	R
Lysimachia vulgaris	R
Lythrum salicaria	R
Mentha aquatica	R
Menyanthes trifoliata	F
Phragmites australis	F
Potentilla palustris	R
Ranunculus flammula	R
Salix sp.	R
Schoenoplectus lacustris	D
Scutellaria galericulata	R
Succisa pratensis	R
Tussilago farfara	R
Typha latifolia	R
Valeriana officinalis	R

Submerged & floating species	% Frequency (n = 28)
Elodea canadensis	32
Fontinalis antipyretica	4
Lemna minor	+
Lemna trisulca	50
Nuphar lutea	82
Utricularia australis	29

Survey data

Site Condition Assessment: Knockballymore (B) (06/07/2014)

Lake Details		**Survey Details**		
Lake Name	Knockballymore (B)	Survey Date	06/07/2014	
SSSI Name		Surveyors	SG, BG, EA	
SAC Name	Magheraveely Marl Lakes	Shore Surveys	1	out of
Grid Ref (centre)	H477268	Wader Surveys	1	1
WBID / NI No.	50385 / 950	Boat Surveys	1	sections

Site Notes:
site steeply sloping from shore with narrow band of N lut. all round lake to approx 2 m

Survey Notes:
Site more or less clear. Utric with flower - U. australis

Section Summaries

Section 1

Maximum depth of colonisation (cm)	230 cm
Compass bearing of boat transect (°)	340 °
Lateral distance from waters edge to 75cm depth (m)	1 m

Notes: Boat survey -very short transect, steeply shelving

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H4791326981	H4782526954	H4786726974	H4786526967

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0031	0032	0034

3.66. Back Lough (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	30 June 2014
NI Lake Number:	956
WBID:	50272
County:	Fermanagh
Grid reference:	H458307
OS Grid reference (X,Y):	232372,333243
Shoreline development index:	1.141
Surface area (ha.):	4.4
Maximum recorded depth (m):	6.3

Table 336 Condition Assessment Summary Table for Back Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species and 1 broad-leaved *Potamogeton* spp.	**X**	3 characteristic species present in 2014: *Callitriche* sp., *Potamogeton alpinus & P. praelongus*.
	No loss of characteristic species	✓	No loss of characteristic species since the 1988 survey, although different methods used.
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	**X**	43% of vegetated sample spots comply

Attribute	Target	Status	Comment
Negative indicator species	Negative indicator species absent or at low frequency	**X**	*Elodea canadensis* present
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 10% of sample points
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Mean cover score < 1; median = 0, and overall cover low.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Species rich emergent zone with *P. australis* dominating and interspersed with *S. lacustris*. Submerged and floating leaved vegetation species rich and zoned to some extent. *Nuphar lutea* fringes the lough (0.5 – 2.0 m). *L. trisulca, L. minor, P. alpinus* and *E. canadensis* are common between depths of 0.25 -0.75m and *P. natans* occurs sporadically at these depths. A zone of *P. praelongus* is present at the depths 1.1-1.3m.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 6.3 m; Z_s = 1.34m; Z_v = 2 m.
	At least the present structure should be maintained	✓	No change evident since NILS 1988
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 67 μgl^{-1} (56 - 82 μgl^{-1}) & TN = 1.28 mgl^{-1} (Apr'14 – Feb'15)
	Stable pH / ANC values: pH >7.00 & <9.00	✓	pH = 7.66 (range = 7.54 – 7.82)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline.	**X**	Surface water well oxygenated, but falling to a mean of 0.5 mgl^{-1} below the thermocline at 3 m
	No excessive growth of cyanobacteria or green algae	**✓?**	High Chl *a* in April 2014
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	*Potamogeton praelongus* present in 1988, still present in this survey
	Minimal negative impacts and no fish farming	✓	Moderate grazing pressure from cattle.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 4.4 ha, with no loss of extent of open water.

Macrophyte community composition

Back Lough has a relatively species rich submerged and floating leaved aquatic macrophyte flora, although it doesn't contain the required number of characteristic species for this lake type under CSM guidelines (JNCC, 2015) to meet favourable status. In the 2014 survey 10 aquatic species were recorded, three of which were characteristic for a natural eutrophic lake. In 1989 a survey was performed using different methods to the recent survey (NILS). The taxa recorded in both surveys were similar although *Hippuris vulgaris* and *Potamogeton berchtoldii* were both recorded in 1989 but not in 2014. Taxa recorded in 2014 but not in 1989 were *Potamogeton alpinus* and *Callitriche sp*. *Potamogeton praelongus*, a species which doesn't respond well to increasing eutrophication, was recorded in both 1989 and 2014 and does not appear to have decreased over that period. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site do however suggest an increase in trophic status at the site during the period between the two survey years.

Table 337 Aquatic macrophyte community composition for Back Lough, including trophic scores.

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1-5)**	**TRS**	**PLEX**	**% occurrence (n=51)***
Callitriche sp.				**-**	**-**	**2.0**
Elodea canadensis	8.5	7.95	2	8.5	7.95	9.8
Fontinalis antipyretica	6.3	5.38	3			-
Hippuris vulgaris	7.7	7.88	2			-
Lemna minor			-	9.0	8.85	37.3
Lemna trisulca			-	10.0	8.85	2.0
Nuphar lutea	8.5	6.92	4	8.5	6.92	82.4
Potamogeton alpinus			**-**	**5.5**	**5.38**	**21.6**
Potamogeton berchtoldii	7.3	7.69	1			-
Potamogeton natans	6.7	4.23	1	6.7	4.23	1.0
Potamogeton praelongus	**7.3**	**5.38**	**3**	**7.3**	**5.38**	**23.5**
Sparganium emersum			-	10.0	7.50	3.9
Average score	**7.5**	**6.42**		**8.2**	**6.88**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Negative indicator species

Elodea canadensis was recorded at a frequency of 9.8% in 2014, but was not recorded in 1989 (NILS). The recent colonisation of an invasive non-native species is

unfavourable under the new JNCC guidelines (2015). No other negative indicator species were present, but the site is used for boat and shore angling and thus stringent biosecurity measures should be publicised and adhered to limit the spread of invasive species.

Macrophyte community structure

Back Lough is largely surrounded with rough pasture with many small fields bordered by hedges. The lough has a species rich emergent zone dominated by *Phragmites australis* and interspersed with *Schoenoplectus lacustris* beds. Other commonly encountered marginal and emergent species include: *Carex rostrata, Typha latifolia, Alisma plantago-aquatica, Ranunculus flammula* and *Mentha aquatica*. Within the open water, *Nuphar lutea* fringes the lough (0.5 – 2 m) with *P. alpinus and P. natans* and growing between 0.5 – 1 m. *P. praelongus* occurs sporadically in shallow water, but mainly occurs in a zone at 1.1 – 1.3 m depth alongside *N. lutea*. No submerged plants grow beyond the outer extent of the *N. lutea* fringe at 2.0 m. A full species list is given in Table 340 below.

Water quality

Table 338 Water chemistry data for Back Lough

	Apr '14	Aug '14	Nov '15	Feb '15	Mean	1988
TP	64.5	56.4	81.9	66.1	**67.2**	30
SRP	8.1	18.7	29.6	39.1	**23.9**	8
TN	1.21	0.99	1.42	1.48	**1.28**	1.08
TON	0.118	<0.005	0.172	0.447	**<0.185**	-
Nitrite	0.004	<0.001	0.010	0.003	**<0.005**	-
Chl *a*	32.12	6.16	7.04	1.32	**11.66**	24.6
DOC	12.2	13.6	15.1	13.9	**13.7**	-
pH	7.8	7.82	7.54	7.56	**7.66**	8.24
Alk	104	113	91	89	**99**	80
Cond	233	241	212	224	**227.5**	332
Ca^{2+}	42.1	44.7	39.6	39.1	**41.4**	50.4
Mg^{2+}	2.25	2.49	2.25	2.23	**2.31**	2.8
Na^{+}	6.77	6.5	6.48	7.38	**6.78**	5.35
K^{+}	2.07	2.08	2.47	2.32	**2.24**	0.75
Cl^{-}	13.1	11.3	12.1	15.8	**13.1**	13.2
SO_4^{2-}	<10	8.93	9.98	11	**<9.978**	5.9

Back Lough is a shallow (Z_{max} recorded = 6 m), eutrophic lake with high annual mean TP (67.2 $\mu g l^{-1}$) and TN (1.28 $mg l^{-1}$) which classifies it as "unfavourable" with respect to trophic status. The mean annual chlorophyll *a* concentration is within the acceptable limit suggested for 'good' ecological status (23 $\mu g l^{-1}$ has been suggested as the upper limit for Chl *a* in HA VSh lakes (Willby et al, 2006)), although the spring

value is high. The water column was well oxygenated above 2m (>6.66 mgl^{-1}), but the site rapidly becomes de-oxygenated below the thermocline at 3.0 m (Figure 67).

Hydrology

Back Lough is close to the source of a tributary of the River Finn that joins the river near Clones. A small inflow joins the lough at its eastern edge and the outflow exits at the western end. The hydrology of the site appears to be under natural control.

Lake substrate

The lake substrate is predominantly silty which is consistent with the underlying geology and alluvial soils in the catchment.

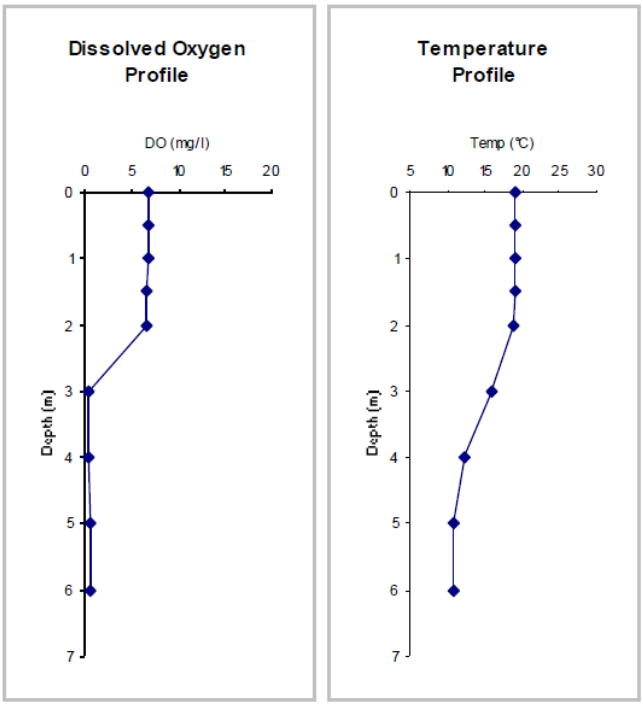
Figure 67 Dissolved oxygen and temperature profile for Back Lough (30/07/2014)

Dissolved Oxygen Profile

GPS Location	H4583930702
Maximum Depth (m)	6.3 m
Secchi Depth (cm)	1.34 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	6.78	19
0.5	6.76	19
1	6.72	19
1.5	6.68	19
2	6.66	18.9
3	0.41	15.9
4	0.46	12.3
5	0.51	10.9
6	0.57	10.8



Sediment load

The lake is surrounded by rough and semi-improved pasture and there is no evidence of increased sediment loading from agricultural improvement or poaching. No additional evidence of increased sediment sources was noted from the catchment.

Indicators of local distinctiveness

The presence of *Potamogeton praelongus* and *P. alpinus* is worthy of note. These broad-leaved species are often lost as sites become more eutrophic and their presence here is encouraging. Site management should aim to preserve these species by alleviating nutrient inputs where possible.

Summary

Despite failing to meet current guidelines the lough appears to have been relatively stable over the past 25 years with respect to its flora. *Potamogeton praelongus* remains frequent in the lough and *P. alpinus* was also common, although not recorded in 1989. Both of these broad-leaf pondweed species are susceptible to eutrophication, yet remain present in the lough at a good abundance. Chlorophyll *a* levels were low as was filamentous algal growth. The presence of *E. canadensis,* although at relatively lo frequency, is nonetheless unfavourable.

Back lough therefore fails to meet the CSM (JNCC 2015) criteria for either its characteristic submerged flora or its trophic status and is classified as being in **unfavourable** condition. No evidence of direct nutrient inputs was observed, but the lough lies within an area of improved pastures with moderate grazing pressure from cattle. Nutrient levels suggest enrichment from within the catchment and it is recommended that this be investigated and where possible, steps taken to reduce inputs.

Table 339 Back Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Back Lough NI Lake 956	Unfavourable	TP exceeds upper permissible limit. Only 3 characteristic species present *Elodea canadensis* present.	Although lacking in species *richness,* the site maintains a good population of *P. praelongus* and *P. alpinus* and does not appear to suffer from high algal turbidity. Catchment sources of nutrients should be investigated further.

Species list

Table 340 List of all plant species recorded at Back Lough

Marginal & Emergent species	Abundance (DAFOR)
Phragmites australis	F
Equisetum fluviatile	O
Schoenoplectus lacustris	O
Salix sp.	O
Alnus glutinosa	O
Typha latifolia	O
Mentha aquatica	O
Lythrum salicaria	R
Menyanthes trifoliata	R
Epilobium hirsutum	R
Potentilla palustris	R
Filipendula ulmaria	R
Stachys palustris	R
Carex rostrata	R
Angelica sylvestris	R
Myosotis scorpioides	R
Ranunculus flammula	R
Galium palustre	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Alisma plantago-aquatica	R
Caltha palustris	R
Elodea canadensis	R
Sparganium emersum	R
Butomus umbellatus	R
Juncus effusus	R
Submerged & floating species	**% Frequency (n = 40)**
Callitriche sp.	2
Elodea canadensis	10
Lemna minor	37
Lemna trisulca	2
Menyanthes trifoliata	14
Nuphar lutea	82
Potamogeton alpinus	22
Potamogeton natans	1
Potamogeton praelongus	24
Sparganium emersum	4

Survey Data

Site Condition Assessment: Back Lough (30/07/2014)

Lake Details		**Survey Details**	
Lake Name	Back Lough	Survey Date	30/07/2014
SSSI Name		Surveyors	SD & EW
SAC Name		Shore Surveys	2 out of
Grid Ref (centre)	H458307	Wader Surveys	2 2
WBID / NI No.	50272 / 956	Boat Surveys	2 sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	170 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	2 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	200 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	-
		Notes: duck mussel. Dead fontinalis @ 130cm	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H4574730732	H4579230821	H4577730776	H4578630770
Section	**2**	H4586930622	H4592430710	H4591330658	H4589630671

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	0095	0096	0097
Section	**2**	0098	0099	0100

3.67. Inver Lough (HA_Sh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation.

Survey Date	03/07/2014
NI Lake Number:	992
WBID:	50118
County:	Fermanagh
Grid reference:	H520312
OS Grid reference (X,Y):	251990,331213
Shoreline development index:	1.715
Surface area (ha.):	12.7
Maximum recorded depth (m):	6.3

Table 341 Condition Assessment Summary Table for Inver Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species and 1 broad-leaved *Potamogeton* spp.	**X**	4 characteristic species: *Potamogeton praelongus, U. vulgaris, Chara contraria* and *Chara rudis* (*Chara* spp recorded outside survey sections).
	No loss of characteristic species	**X**	*Potamogeton perfoliatus* present in 1989 but not 2014.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat & wader survey) have ≥ 1 characteristic species	**X**	37% of vegetated sample spots comply (mainly *Utricularia vulgaris*)
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 11% of submerged sample points.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Good marginal habitat with broadleaf woodland, herbs and dense reeds dominated by *P. australis, E. fluviatile* & *S. lacustris,* growing up to 1.2 m depth with occasional *C. rostrata, T. latifolia* & *S. erectum. C. mariscus* in S2. *M. trifoliata* occasional in shallows. Mosaic structure within aquatic flora, with *N. lutea* & *L. trisulca* interspersed within emergents and out into open water (0.25 – 2.9 m). *U. vulgaris* in S1 – 4 frequent. *P. natans* & *P. praelongus* occasional (0.75 m – 2.7 m) intermingled by occasional *E. canadensis* (0.25 - >0.75 m). *F. antipyretica* only in S4 (0.25 – 2 m). No plant growth at depths > 2.9 m.
	Maximum depth distribution should be maintained	✓**?**	Z_{max} (recorded) = 6.3 m, Z_s = 1.05 m, Z_v = 2.9 m; turbid.
	At least the present structure should be maintained	✓	No change evident. Similar composition to NILS 1989
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 35 μgl^{-1}	✓	TP = 33.0 μgl^{-1} (range = 22.0 – 43.9 μgl^{-1}) & TN = 0.8 mgl^{-1} (April '14 – Feb. '15)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 8.1 (range = 8.05 – 8.13)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline.	**X**	Waters were well oxygenated to 2.0 m (8.1 – 7.37 mgl^{-1}), but fell to a mean of 0.2 mgl^{-1} below the thermocline at 3.5 m.
	No excessive growth of cyanobacteria or green algae	✓	No blooms present, although water slightly turbid
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Fishing platform present but otherwise natural shoreline.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of increased sediment loads.

Attribute	Target	Status	Comment
Indicators of local distinctiveness	Distinctive elements maintained	✓	Broad-leaved *Potamogeton* spp. present.
	Minimal negative impacts and no fish farming	**X?**	Shore angling and possible drainage from nearby buildings. Slurry on adjacent fields is of concern.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 12.7 ha, with no loss of extent of open water.

Macrophyte community composition

Table 342 Aquatic macrophyte community composition for Inver Lough, including trophic scores.

	1989			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**DAFOR**	**TRS**	**PLEX**	**% occurrence (n=119)***
Chara contraria	**-**	**-**	**-**	**8.5**	**7.69**	**+**
Chara rudis	**-**	**-**	**-**	**8.5**	**7.69**	**+**
Chara vulgaris	**8.5**	**7.69**	**1**	**-**	**-**	**-**
Elodea canadensis	8.5	7.95	2	8.5	7.95	10.9
Fontinalis antipyretica	6.3	5.38	4	6.3	5.38	5.0
Hippuris vulgaris	-	-	-	7.7	7.88	+
Lemna minor	9.0	8.85	1	9.0	8.85	1.7
Lemna trisulca	10.0	8.85	3	10.0	8.85	39.5
Nuphar lutea	8.5	6.92	5	8.5	6.92	81.5
Potamogeton natans	6.7	4.23	4	6.7	4.23	40.3
Potamogeton perfoliatus	**7.3**	**7.69**	**1**	**-**	**-**	**-**
Potamogeton praelongus	**7.3**	**5.38**	**3**	**7.3**	**5.38**	**4.2**
Utricularia vulgaris	**5.5**	**4.23**	**1**	**5.5**	**4.23**	**37.0**
Average score	**7.8**	**6.72**		**7.9**	**6.82**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

A plus (+) denotes taxa recorded as present at the site but not found growing in the survey sections

Inver Lough only supports only four characteristic species, including one broad-leaved *Potamogeton* spp. (*Chara contraria, Chara rudis, Potamogeton praelongus*), although the two species of *Chara* were not observed in the survey sections but were present at the site. *Chara rudis* is rare in the UK (Stewart 2004), with Fermanagh being an important area for the species. The species assemblage is similar to that recorded in 1989 (NILS), although *P. perfoliatus* was recorded in 1989 along with *Chara vulgaris (*but no other *Chara* spp.). It is worthy of note that

Potamogeton praelongus was recorded as “frequent” in 1989, but was rare in 2014, suggesting an overall decline in this board-leaf species. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site was 7.9 and 6.82 respectively, which are similar to the 1989 survey scores, but do show a slight increase in trophic status (Table 342).

Negative indicator species

Elodea canadensis was recorded with an overall frequency of 11% in 2014 and as occasional in 1989 and can therefore be assumed to be well established and stable at the site. The presence of any non-native species as an established part of the plant community is considered as unfavourable within the CSM guidance (JNCC 2015).

Macrophyte community structure

Inver Lough is bounded by a good marginal habitat, consisting of broadleaf woodland, herbs and a dense *Scirpo-Phragmitetum* community, dominated by *Phragmites australis, Equisetum fluviatile* and *Schoenoplectus lacustris.* These species were found to be growing up to 1.2 m water depth towards the east end of the lough. *Carex rostrata, Typha latifolia* and *Sparganium erectum* complimented this community throughout the survey, with a stand of *Cladium mariscus* recorded on the northeast shore. *Nuphar lutea* was recorded growing with abundance in the shallow margins of the reeds, extending out to the open water as deep as 2.9 m. This was interspersed by *Lemna trisulca*, growing out to similar depths. *Menyanthes trifoliata* was observed growing occasionally along the southern shore, up to depths of > 0.75 m, together with *Utricularia vulgaris* . Intermingled among the *N. lutea, Potamogeton natans* was observed frequently between depths of 0.75 m to 2.7 m across the lough, while *Potamogeton praelongus* was only seen sporadically in confined areas on the north and south shores between depths of >0.75 m and 2.1 m. *Elodea canadensis* was recorded in all survey sections, but at rare abundance, between 0.25 - >0.75 m. Unlike in 1989 when *Fontinalis antipyretica* was recorded as abundant (‘4’ on a 1-5 scale), this species was observed only on the north side of the lough with rare abundance in depths of 0.25m to 2 m. *Cicuta virosa* was recorded once, on the southwest shore in the shallows. No plants were found beyond the depth of 2.9 m. In addition, two species of charophytes were recorded on the strandline of the southern shore, *C. contraria* and the regionally rare *C. rudis.* A full species list is given in Table 345. The overall mosaic and depth distribution is considered to be favourable, albeit without the full complement of characteristic species.

Water quality

Inver Lough is classified as a naturally eutrophic lake and falls within the ‘shallow’ category (Z_{max} = 6.3 m) under the UK WFD lake typology. The current TP concentration (33.0 μgl^{-1}) therefore places the site within the target level set by the CSM (JNCC 2015), but outside the acceptable limit for “high” status within the more stringent criteria set out UK WDF and WFD (Priority Substances and Classification) Regulations NI (see Carvalho *et al,* 2006 & WFD (NI)). In 1989 a spot water sample recorded a higher TP concentration of 51 μgl^{-1} which suggests that the site may have improved in terms of trophic status over the last 26 years, although the data are insufficient to confirm this. The mean annual chlorophyll *a* concentration is relatively high, but all values are lower than that recorded from the summer spot sample in

1989. The water column was well oxygenated in the upper 2.0 m (8.1 – 7.37 mgl^{-1}), but below the thermocline at approximately 3.0 m it fell rapidly to a mean of only 0.2 mgl^{-1} (Figure 68). Overall, Inver Lough is assessed as being borderline favourable in respect to trophic status, but unfavourable for dissolved oxygen.

Table 343 Water chemistry data for Inver Lough

	Apr. '14	Aug. '14	Nov. '15	Feb. '15	Mean	1989
TP	43.9	27.9	38.1	22.0	**33.0**	51.00
SRP	2.9	1.0	1.7	1.7	**1.8**	4.00
TN	0.66	0.73	0.78	0.99	**0.79**	0.99
TON	<0.005	<0.005	0.06	0.29	**0.09**	0.03
Nitrite	<0.001	<0.001	0.00	0.01	**0.00**	-
Chl *a*	14.7	15.8	28.3	20.2	**19.8**	42.9
DOC	6.88	6.99	6.61	7.49	**6.99**	-
pH	8.05	8.13	8.11	8.12	**8.10**	8.16
Alk	188	181	199	172	**185**	116
Cond	392	379	375	372	**379.5**	421
Ca^{2+}	79.9	74.7	75.6	73.2	**75.85**	71.60
Mg^{2+}	3.73	3.75	3.80	3.45	**3.68**	3.40
Na^{+}	7.23	6.80	7.02	7.28	**7.08**	3.80
K^{+}	2.09	1.97	2.11	2.30	**2.12**	1.15
Cl^{-}	14.60	13.70	13.80	15.50	**14.40**	13.00
SO_4^{2-}	11.30	6.95	7.31	12.70	**9.57**	11.60

Hydrology
The hydrological regime at the site appears natural.

Lake substrate
The lake substrate is predominantly silty, which is consistent with the underlying geology and alluvial soils in the catchment. The underlying bedrock consists of limestone, which is overlain by a later of till.

Sediment load
The site is well buffered around most of its margins and was without any major disturbance that might impact sediment loadings. Slurry spreading was however observed on nearby fields which has the potential to increase external loadings of organic material and nutrients.

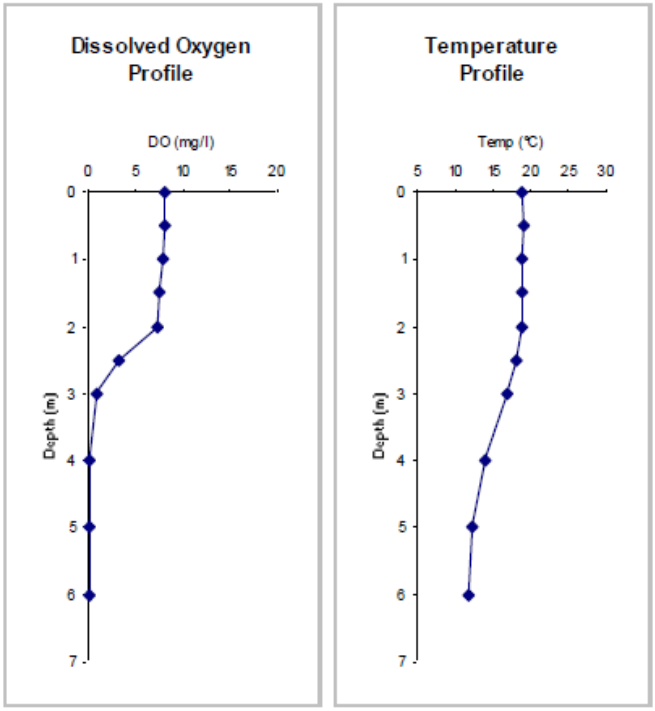
Indicators of local distinctiveness
Two broad-leaved *Potamogeton* species were recorded in 1989: *P. praelongus* and *P. perfoliatus.* The latter species was not present in the 2014 survey however. The regionally rare *Chara rudis,* which is listed as “lower risk, near threatened” (IUCN, 2001) is present within the lough.

Figure 68 Dissolved oxygen and temperature profile for Inver Lough (03/07/2014)

Dissolved Oxygen Profile

GPS Location	H5220131238
Maximum Depth (m)	6.3 m
Secchi Depth (cm)	100 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.1	18.9
0.5	8.07	19
1	7.92	18.9
1.5	7.64	18.9
2	7.37	18.9
2.5	3.23	18.1
3	0.95	17
4	0.15	14
5	0.18	12.4
6	0.24	11.9



Summary

Inver Lough appears to have improved with respect to trophic status since 1989 with current TP concentrations just within the CSM guidance limits. The lough does however show signs of eutrophication with relatively high algal turbidity and chlorophyll a concentrations throughout the year. Despite having reasonable water quality however, Inver Lough does not meet the criteria for submerged and floating leaved flora, supporting only four characteristic species, including one broad-leaved *Potamogeton* spp. (*P. praelongus*), the latter which appears to have declined since 1989.

While the site does not achieve all the criteria required within the CSM for favourable status, it does nonetheless support a diverse range of aquatic flora, including the regionally rare *C. rudis,* an addition to the surveyed list of species from 1989. The site also has an extensive *Scirpo-Phragmitetum* community which supports a good range of emergent/marginal flora.

The site is classified as **unfavourable** due primarily to its lack of characteristic species. Palaeoecological analysis would help to identify the extent and timings of change of both the flora and the water quality. A better understanding of the past flora would allow site specific targets to be set against which a more accurate assessment could be determined.

Agricultural improvements are likely to have resulted in diffuse nutrient pollution to the site, a situation that is likely to be accelerated by the increased application of slurry within the catchment. Although the nutrient chemistry currently falls just within the

criteria set by the CSM (JNCC 2015), the site is at risk of future nutrient enrichment and should therefore be monitored.

Table 344 Inver Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Inver Lough NI Lake 992	**Unfavourable**	Fails to meet CSM species target Possible decline of broad-leaf *Potamogeton* spp. Borderline water quality	Only 4 characteristic species present in 2014, but flora nonetheless shows good structure. Slurry spreading observed on nearby fields, this should be monitored for any nutrient input to the lough. Permit no fish stocking.

Species list

Table 345 List of all plant species recorded at Inver Lough.

Marginal & Emergent species	Abundance (DAFOR)
Agrostis stolonifera	O
Alnus glutinosa	F
Angelica sylvestris	R
Caltha palustris	R
Cardamine amara	R
Cardamine pratensis	R
Carex acutiformis	R
Carex paniculata	O
Carex remota	O
Carex rostrata	O
Cicuta virosa	R
Cirsium palustre	R
Cladium mariscus	R
Epilobium parviflorum	R
Equisetum fluviatile	F
Filipendula ulmaria	O
Galium palustre	O
Iris pseudacorus	R
Juncus effusus	R
Lycopus europaeus	R
Menyanthes trifoliata	O
Phalaris arundinacea	R
Phragmites australis	A
Potentilla palustris	R
Ranunculus sceleratus	R
Ribes uva-crispa	R
Salix sp.	F
Schoenoplectus lacustris	A
Sparganium erectum	R
Valeriana officinalis	R
Veronica beccabunga	R
Veronica scutellata	R

Submerged & floating species	% Frequency (n = 119)
Elodea canadensis	11
Fontinalis antipyretica	5
Lemna minor	2
Lemna trisulca	40
Nuphar lutea	82
Potamogeton natans	40
Potamogeton praelongus	4
Utricularia vulgaris	37
Chara contraria	+
Chara rudis	+
Hippuris vulgaris	+

Survey data

Site Condition Assessment: Inver Lough (03/07/2014)

Lake Details		**Survey Details**		
Lake Name	Inver Lough	Survey Date	03/07/2014	
SSSI Name		Surveyors	SG, BG	
SAC Name		Shore Surveys	4	out of
Grid Ref	H520312	Wader Surveys	4	4
WBID / NI No.	50118 / 992	Boat Surveys	4	sections

Site Notes:
Turbid - used as a mixed fishery - otter present. Slurry spreading nearby fields! Fishing platforms along north shore.

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	290 cm
		Compass bearing of boat transect (°)	200 °
		Lateral distance from waters edge to 75cm depth (m)	7 m
		Notes: Dense phrag/schoeno with N.lut & sparse P.nat to c	
Section	**2**	Maximum depth of colonisation (cm)	270 cm
		Compass bearing of boat transect (°)	270 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: Dense E.fluv - Phrag - S.lac - N.lut& Pot prae	
Section	**3**	Maximum depth of colonisation (cm)	270 cm
		Compass bearing of boat transect (°)	200 °
		Lateral distance from waters edge to 75cm depth (m)	6 m
		Notes:	
Section	**4**	Maximum depth of colonisation (cm)	200 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes: P3 located next to landing stage (+P5)	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H5216031077	H5205931088	H5210631087	H5210731101
Section	**2**	H5211331342	H5208531249	H5211031293	H5211631290
Section	**3**	H5172231132	H5165631212	H5168231161	H5169231195
Section	**4**	H5179631274	H5189431289	H5184731282	H5184831278

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	2561	2562	2563
Section	**2**	2564	2565	2566
Section	**3**	2569	2571	2770
Section	**4**	2572	2573	2574

3.68. Rose Lough (HA VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	02 July 2014
NI Lake Number:	999
WBID:	50519
County:	Fermanagh
Grid reference:	H512298
OS Grid reference (X,Y):	251152,329780
Shoreline development index:	*1.093*
Surface area (ha.):	1.8
Maximum recorded depth (m):	3.1

Table 346 Condition Assessment Summary Table for Rose Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species & 1 broad-leaved *Potamogeton* spp.	**X?**	5 present: *Chara globularis*, *Callitriche* sp, *Spirodela polyrhiza, Utricularia vulgaris* agg. and the broad leaf *Potamogeton lucens*.

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	*Potamogeton crispus* was recorded in 1989 as rare.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	**X?**	Only 46 % of sample spots comply (64% wader, 15% boat survey).
Negative indicator species	Negative indicator species absent or at a low frequency	**✓?**	*Elodea canadensis* present at low frequency. No other negative species.
	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* present at 6% frequency. Also present in 1989 also at low abundance.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Generally low. Median cover score = 0 and overall cover <5%.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Extensive wetland fringe with species rich margins dominated by *Schoenoplectus lacustris, Equisetum fluviatile, Ranunculus lingua, Cicuta virosa, Phragmites australis* backed by *Salix* sp. to the east side. Open water dominated by *N. lutea* (25 – 200 cm) and *P. natans* (50 – 250 cm). *L. trisulca* sparse to 130 cm. *U. vulgaris* agg. frequent in the margins to 120 cm. *P. lucens* rare and restricted to shallow water among reeds. Other species mainly <120 cm and infrequent. Good wetland fringe.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 3.10 m; Z_s = 1.00 m; Z_v = 2.50 m.
	At least the present structure should be maintained	✓	Species composition and abundance similar to the 1989 NILS data.
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 87.4 μgl^{-1} (39–181 μgl^{-1}) & TN = 1.47 mgl^{-1} Apr'14 – Feb'15
	Stable pH / ANC values: pH >7.00 & <9.00	✓	pH = 7.57 (range = 7.27 – 8.13)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	**X**	Well oxygenated in the upper 1.0 m with DO > 10 mgl^{-1} at the surface, reducing to 0.2 mgl^{-1} below 2 m depth.
	No excessive growth of cyanobacteria or green algae	✓	No blooms present during sampling, but water with some algal turbidity noted

Attribute	Target	Status	Comment
Hydrology	Natural hydrological regime	✓?	Past lowering? Now under natural control and well connected through the hydrosere to surrounding area.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	None specified.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.8 ha, with no loss of extent of open water due to anthropogenic disturbance.

Macrophyte community composition

Rose Lough supports a total of five characteristic species inclusive of one broad-leaved *Potamogeton* sp.: *Chara globularis, Callitriche* sp. (no flowers or fruits), *Spirodela polyrhiza, Utricularia vulgaris* agg. and *Potamogeton lucens*. With the exception of the bladderwort, all the characteristic species were rare within the site and only 46%of the survey points contained one or more characteristic eutrophic species. Seven other aquatic species were recorded (Table 367), with *Nuphar lutea,* and *Potamogeton natans* comprising the most abundant species growing around most of the lough to a maximum depth of 2.1 m and 2.5 m respectively.

The site was surveyed in 1989 (NILS) and overall the flora was similar to that recorded in 2014, although two additional characteristic species were recorded: *P. crispus* ("1" on a 1-5 scale) and *Callitriche hamulata* (*C. brutia*?). *Sparganium emersum* and *Hippuris vulgaris* were also recorded in 1989, but not seen in 2014. The non-native *Elodea canadensis* was present at low frequency and was also recorded in 1989, suggesting it to be well established within the site, albeit at low abundance.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site was 8.3 and 6.93 respectively which suggests a slight increase in trophic status compared to the 1989 assemblage (8.0 and 6.82 respectively).

Negative indicator species

Elodea canadensis is long established within the site, although at relatively low abundance. Any self-sustaining population of a high-impact non-native species is considered unfavourable within the CSM guidance (2015). There were no other negative indicator species and filamentous algal cover was relatively low with only 1 survey points receiving a cover score of 3 for filamentous algae.

Table 347 Aquatic macrophyte community composition for Rose Lough, including trophic scores.

	1989 (NILS)			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**Abundance (1 - 5)***	**TRS**	**PLEX**	**% occurrence (n=68)***
Callitriche hamulata	**5.0**	**6.15**	**1**			**-**
Callitriche sp.	**7.7**	**7.69**	**1**	**7.7**	**7.69**	**1**
Chara globularis	**8.5**	**7.69**	**1**	**8.5**	**7.69**	**7**
Elodea canadensis	8.5	7.95	2	8.5	7.95	6
Fontinalis antipyretica	6.3	5.38	2			-
Hippuris vulgaris	7.7	7.88	1			-
Lemna minor			-	9.0	8.85	12
Lemna trisulca	10.0	8.85	1	10.0	8.85	65
Myriophyllum spicatum	10.0	8.85	3	10.0	8.85	7
Nuphar lutea	8.5	6.92	5	8.5	6.92	74
Nymphaea alba	6.7	3.08	3	6.7	3.08	12
Potamogeton crispus	**8.5**	**7.95**	**1**			**-**
Potamogeton lucens	**10.0**	**7.88**	**2**	**10.0**	**7.88**	**4**
Potamogeton natans	6.7	4.23	3	6.7	4.23	49
Sparganium emersum	10.0	7.50	1			-
Spirodela polyrhiza			**-**	**-**	**-**	**4**
Utricularia vulgaris agg.	**5.5**	**4.23**	**1**	**5.5**	**4.23**	**40**
Average score	**8.0**	**6.82**		**8.3**	**6.93**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Rose Lough lies within an extensive wetland area grading into Salix scrub around the north and east of the lough and to fen and wet pasture around much of the south and west. This wetland community is particularly rich and would benefit from further survey. Notable species include *Cicuta virosa* and *Ranunculus lingua,* both of which are very common at this site.

The lough edge is fringed with emergent reed and areas of floating “hover”, dominated by *Phragmites australis* and *Schoenoplectus lacustris* growing out to 75 cm, often with *U. vulgaris* agg. *L. trisulca, L. minor* and *S. polyrhiza* present beneath. In open water, *Nuphar lutea* forms a dominant band around the lough to approximately 200 cm with *N. alba* occasional. *Potamogeton natans* was common within the lilies, but also reach into slightly deeper water with a maximum recorded depth of 250 cm. *Utricularia vulgaris* agg. was frequent within the margins at low abundance, often just within the stems of the emergent reed beds. Other species were less frequent and mainly confined to shallow water. *Potamogeton lucens* was recorded only on the east side growing within the shelter of *S. lacustris* beds. *Chara globularis* also rare and restricted to the east side where it was only recorded at low abundance glowing beneath *N. lutea.* The maximum depth of macrophyte colonisation was 2.5 m (*P. natans*), beyond which the water was turbid and without submerged aquatic macrophytes.

Water quality

Rose Lough is classified as a naturally eutrophic lake and falls within the 'very shallow' category (Z_{max} = 3.1 m) under the UK WFD lake typology. Mean annual total phosphorus concentration (87.4 μgl^{-1}) was well above CSM limits for this site type and total nitrogen also exceeded the 1.5 mgl^{-1} limit during 2 sampling quarters (JNCC 2015). The current water quality is therefore unfavourable. In 1989 a spot water sample recorded TP and TN of 24 μgl^{-1} and 0.6 mgl^{-1} respectively which suggests that the site has deteriorated over the past 25 years. Despite high nutrients, the mean annual chlorophyll *a* concentration is relatively low, but episodes of high algal biomass may have been missed by quarterly sampling; the water clarity was certainly very poor due to algal turbidity during the survey in July 2014. Dissolved oxygen levels were also poor in July, with concentrations dropping rapidly to zero below the thermocline at 1.5 m (Figure 73). Overall, Rose Lough is assessed as being unfavourable in respect to water quality.

Table 348 Water chemistry data for Rose Lough

	Apr'14	Aug'14	Nov '14	Feb'15	Mean	1989
TP	48.4	80.8	181.0	39.3	87.4	24
SRP	8.0	15.4	86.4	19.4	32.3	4
TN	1.000	1.210	2.100	1.560	1.468	0.60
TON	0.005	0.018	0.729	0.840	0.398	0.01
Nitrite	0.001	0.001	0.009	0.003	0.003	-
Chl a	10.8	1.1	5.0	4.5	5.3	19.8
DOC	10.6	11.6	17.4	9.6	12.3	-
pH	8.1	7.7	7.3	7.6	7.57	8.26
Alk	252	252	60	180	186	294
Cond	485	474	162	403	381	381
Ca^{2+}	102.0	98.8	25.2	80.3	76.6	100.6
Mg^{2+}	4.1	4.4	2.3	3.3	3.5	4.2
Na^{+}	7.1	7.3	6.7	8.6	7.4	4.2
K^{+}	2.1	2.2	3.2	2.5	2.5	0.5
Cl^{-}	15.1	13.3	12.1	19.3	15.0	12.2
SO_4^{2-}	14.0	8.5	11.6	16.6	12.7	15.2

Hydrology

The site receives water via an inflow from the east that arises in Annachullion Lough as well as a shallow drain to the north. There is an outflow to the west, which has in the past been managed and deepened, but there is no evidence of any recent drainage around the lough. Given the depth of the outflow, it is assumed the lough level was once higher which explains, in part, the extent of the wetlands around the site. The outflow is now clogged with extensive growth of wetland vegetation however and therefore the lough level has probably increased slightly again since deepening of the channel. Although managed in the past, the hydrological regime is currently under natural influence and further intervention should be discouraged.

Lake substrate
The lake substrate is predominantly silty which is consistent with the catchment geology and land use.

Sediment load
The surrounding land is rough and semi-improved grassland. The wet conditions around the margin have discouraged access by cattle and in the most part the site is well buffered and undisturbed. There is light cattle poaching near the outflow, but this is unlikely to cause significant increases sediment loading, and the site otherwise appears undisturbed.

Indicators of local distinctiveness
The primary conservation interest is probably the marginal fen and wetlands rather than the open water. The presence of *Potamogeton lucens* is however of note, and the occurrence of this broad-leaf pondweed should be monitored to ensure it is not lost.

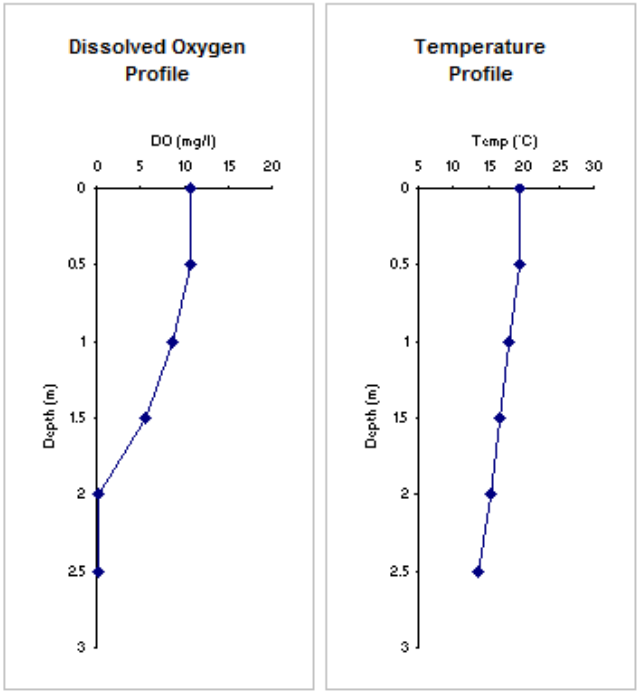
Figure 69 Dissolved oxygen and temperature profile for Rose Lough (02/07/2014)

Dissolved Oxygen Profile

GPS Location	H5114129791
Maximum Depth (m)	3.1 m
Secchi Depth (cm)	100 cm

Notes:

Depth (m)	DO (mg/l)	Temp (°C)
0	10.79	19.4
0.5	10.62	19.4
1	8.58	17.9
1.5	5.52	16.7
2	0.21	15.2
2.5	0.25	13.6



Summary
Rose Lough remains relatively unchanged since the survey conducted in 1989. Five characteristic species were recorded from the lough in 2014, including one broad-leaf *Potamogeton*, but these were mostly rare in the site. The aquatic flora was otherwise typical of a hyper-eutrophic lough with *Nuphar lutea*, *Potamogeton natans* and *Lemna trisulca* dominating the open water. Although present in the site since before 1989, *Elodea canadensis* does not appear to have increased, with current levels lower probably lower now than in 1989.

Water clarity was slightly compromised due to algal turbidity in July 2014, but generally chlorophyll *a* concentrations were low within the site and the water clear. . Total phosphorus concentrations were constantly above the CSM target (JNCC 2015) for eutrophic waters and total nitrogen also high. The site lies within a region of improved and semi-improved pasture (mainly cattle grazing), and is therefore likely to receive diffuse nutrient inputs from the catchment. Other water quality parameters are typical for this lough type.

Despite maintaining elements of a characteristic flora, Rose Lough falls well below the expected criteria for this site type within the CSM (JNCC 2015). High TP and low overall frequency of the characteristic flora result in the site being classified as being in **unfavourable condition**. Aside from the open water, the extensive areas of varied wetland vegetation are of potential interest and would warrant further survey to determine the full extent of their conservation interest. Site management should focus on identifying and reducing nutrient inputs to the site.

Table 349 Rose Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Rose Lough NI Lake 999	Unfavourable	Only 5 characteristic species present in 2014. 46% of sample plots contained one or more characteristic species Nutrient levels exceed CSM targets	The site has remained relatively stable in terms of the flora since 1989, but is hyper-eutrophic. Although the aquatic flora falls below CSM targets, the extensive wetland flora is excellent. Long term nutrient reduction would benefit the lough.

Species list

Table 350 List of all plant species recorded at Rose Lough: 2014

Marginal & Emergent species	**Abundance (DAFOR)**
Alisma plantago-aquatica	R
Alnus glutinosa	O
Angelica sylvestris	O
Caltha palustris	O
Carex acuta	R
Carex disticha	O
Carex elata	O
Carex rostrata	O
Cicuta virosa	F
Epilobium parviflorum	R
Equisetum fluviatile	O
Filipendula ulmaria	O
Galium palustre	O
Glyceria notata	R
Hydrocotyle vulgaris	R
Juncus effusus	O
Lythrum salicaria	O
Mentha aquatica	F
Menyanthes trifoliata	F
Myosotis scorpioides	F
Phalaris arundinacea	F
Phragmites australis	A
Potentilla anserina	O
Potentilla palustris	R
Ranunculus lingua	F
Rorippa nasturtium-aquaticum	O
Salix sp.	A
Schoenoplectus lacustris	A
Senecio aquaticus	R
Typha latifolia	O
Valeriana officinalis	R
Submerged & floating species	**% Frequency (n = 57)**
Callitriche sp.	1
Chara globularis	7
Elodea canadensis	6
Lemna minor	12
Lemna trisulca	65
Myriophyllum spicatum	7
Nuphar lutea	74
Nymphaea alba	12
Potamogeton lucens	4
Potamogeton natans	49
Spirodela polyrhiza	4
Utricularia vulgaris agg.	40

Survey data

Site Condition Assessment: Rose Lough (02/07/2014)

Lake Details		**Survey Details**		
Lake Name	Rose Lough	Survey Date	02/07/2014	
SSSI Name		Surveyors	BG, SG	
SAC Name		Shore Surveys	2	out of
Grid Ref	H512298	Wader Surveys	2	2
WBID / NI No.	50519 / 999	Boat Surveys	2	sections

Site Notes:
Site appears rather turbid

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	250 cm
		Compass bearing of boat transect (°)	220 °
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	250 cm
		Compass bearing of boat transect (°)	320 °
		Lateral distance from waters edge to 75cm depth (m)	3 m
		Notes: Steep drop - 50cm depth at P2 non-existant	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H5118629697	H5110929760	H5114429728	H5114829754
Section	**2**	H5108629798	H5115829856	H51104298843	H5112529828

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	2548	2549	2550
Section	**2**	2552	2553	2555

3.69. Corraharra Lough (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	05 July 2014
NI Lake Number:	1012
WBID:	-
County:	Fermanagh
Grid reference:	H356228
OS Grid reference (X,Y):	235576,328755
Shoreline development index:	1.023
Surface area (ha.):	1.5
Maximum recorded depth (m):	1.5 m

Table 351 Condition Assessment Summary Table for Corraharra Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species and 1 broad-leaved *Potamogeton* spp.	**X**	5 characteristic species present in 2014: *Hydrocharis morsus-ranae, Potamogeton obtusifolius*, *P. praelongus, Spirodela polyrhiza & Utricularia vulgaris* agg. Including one broad-leaved *Potamogeton* i.e. *P. praelongus*.

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	Number of characteristic species down from 7 in 2006 but this is due to CSM guidance changes and not loss of species.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	86% of sample plots comply.
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 28% of submerged sample points (decrease since 2006).
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Good marginal habitat with mix or reed, herbs and wet woodland (Abundance of *P. australis, S. lacustris, C. rostrata, C. elata, J. effuses, I. pseudacorus, S. erectum, P. arundinacea, C. virosa* and *E. fluviatile*). Submerged and floating leaved vegetation species rich and within a mixed mosaic. Plants growing to maximum water depth. *N. lutea*, *S. aloides, L. minor, L. trisulca, S. polyrhiza* common throughout. *P. praelongus* in deepest water where *N. lutea* and *S. aloides* growth thinner (1.3 - 1.5 m)
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 1.5 m, Z_s = 0.95 m, Z_v = 1.5 m; slightly turbid.
	At least the present structure should be maintained	✓**?**	Hydrosere present – no change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**X**	TP = 151 μgl^{-1} (range = 59 - 334) & TN = 1.55 mgl^{-1} (Apr'14 – Feb'15)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.5 (range = 7.3 – 7.7)
	Adequate dissolved O_2 throughout the water column (mean > 6mgl^{-1} below thermocline)	✓**?**	Well oxygenated in the top 50cm (>7mg/l) but DO drops to 5.5mg/l at 1m depth. No thermocline.
	No excessive growth of cyanobacteria or green algae	✓**?**	No blooms present, although water slightly turbid
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.

Attribute	Target	Status	Comment
Sediment load	Natural sediment load maintained	✓?	No clear evidence of increased sediment loads, although some logging activity in catchment and some very slight poaching.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	No change since 2006
	Minimal negative impacts and no fish farming	✓?	Very slight poaching of shore and some logging in catchment.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.5 ha, with no loss of extent of open water.

Macrophyte community composition

Table 352 Aquatic macrophyte community composition for Corraharra Lough, including trophic scores.

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=33)***	**TRS**	**PLEX**	**% occurrence (n=29)**
Elodea canadensis	8.5	7.95	36	8.5	7.95	27.6
Hydrocharis morsus-ranae	**-**	**-**	**39**	**-**	**-**	**37.9**
Lemna minor	9.0	8.85	85	9.0	8.85	27.6
Lemna trisulca	10.0	8.85	94	10.0	8.85	27.6
Myriophyllum verticillatum	-	-	24	-	-	3.4
Nuphar lutea	8.5	6.92	79	8.5	6.92	93.1
Nymphaea alba	6.7	3.08	3	6.7	3.08	6.9
Potamogeton berchtoldii	-	-	-	7.3	7.69	+
Potamogeton obtusifolius	**7.3**	**6.54**	**12**	**7.3**	**6.54**	**+**
Potamogeton praelongus	**7.3**	**5.38**	**30**	**7.3**	**5.38**	**27.6**
Sparganium emersum	10.0	7.5	9	10.0	7.5	24.1
Spirodela polyrhiza	**-**	**-**	**100**	**-**	**-**	**62.1**
Stratiotes aloides	-	-	94	-	-	41.4
Utricularia vulgaris agg.	**5.5**	**4.23**	**12**	**5.5**	**4.23**	**3.4**
Average score	**8.1**	**6.59**		**8.0**	**6.70**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Corraharra Lough has a species rich submerged and floating leaved aquatic macrophyte flora both overall (16 species) and with respect to the representation of characteristic species. In 2014, five characteristic species were recorded, including one broad-leaved *Potamogeton* sp. (*Potamogeton praelongus*). This is a reduction from the seven characteristic species recorded in 2006. This is not due to any loss of species but is caused by the recent updated CSM guidance (JNCC 2015) which no

longer includes *Lemna spp.* as a characteristic species and allows no more than three Hydrocharition species to count towards the total. The lough also has a rich marginal and emergent flora; fifty five different aquatic macrophyte taxa were recorded in 2014. Notable species include *Myriophyllum verticillatum, Butomus umbellatus, Sium latifolium, Stratiotes aloides* and *Oenanthe fistulosa*. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site has not changed significantly from 2006 to 2014. The species composition appears to be stable with all notable species still present in the 2014 survey when compared to the 2006 survey.

Negative indicator species

Elodea canadensis was recorded at an overall frequency of 28%, a slight reduction from 2006 (36%). Any self-sustaining population of a high-impact non-native species is considered unfavourable within the CSM guidance (2015).

Macrophyte community structure

Corraharra Lough is bounded to the west by wet quaking bank (topped by herb-rich wet vegetation) and rough pasture dotted with individual *Alnus glutinosa* and *Salix* sp. trees. To the north there is wet woodland (*Alnus glutinosa* / *Salix* sp.). To the south and east there are tussocks of *Carex elata*. There is rough grazing pasture around the lough, although poaching of the lake shore is minimal due to the dense *Scirpo-Phragmitetum* communities that are found around much of the lake. These comprise mainly *Phragmites australis* and *Schoenoplectus lacustris* alongside a species and herb-rich marginal and emergent zone. This community extends into water depths of approximately 0.75 m, beyond which the open water submerged plant community is dominated by *Nuphar lutea* and *Stratiotes aloides*, with *Potamogeton praelongus* frequently encountered at depths of 1.3 – 1.5 m where the *N. lutea* and *S. aloides* growth is thinner. *Hydrocharis morsus-ranae* was commonly encountered at water depths of 0.25 – 0.75 m. The growth of *Nymphaea alba* was patchy and was only recorded on the boat survey. *Spirodela polyrhiza* was found throughout the lough, growing alongside *Lemna minor* and *Lemna trisulca*. Other species present at low to moderate abundance throughout the open water area were *M. verticillatum, P. obtusifolius, E. canadensis* and *U. vulgaris* agg. Plants were found growing to the maximum depth of the lough (1.5 m), although the water was slightly turbid during the 2014 survey, as was the water in the 2006 survey. A full species list is given in Table 355 below.

Water quality

Corraharra Lough is a small, very shallow (Z_{max} recorded = 1.5 m), hyper-eutrophic lake with high annual mean TP (151 μgl^{-1}) which classifies it as “unfavourable” with respect to trophic status. The mean annual chlorophyll *a* concentration is within the acceptable range for the lake type (23 μgl^{-1} has been suggested as the upper limit for Chl *a* in HA VSh lakes (Phillips 2008)). Both TP and Chl *a* concentrations were particularly high in spring (April 2014), suggesting high algal densities - although the water was only slightly turbid at the time of the macrophyte survey in July 2014, but this turbidity seemed to be caused by suspended sediment not algal blooms. Dissolved Oxygen (DO) drops rapidly in just 1 meters depth but is within the favourable levels under CSM guidance (JNCC 2015). Being a shallow lake wind action should keep the lake oxygenated throughout the water column.

Table 353 Water chemistry data for Corraharra Lough

	Apr ’14	Aug '14	Nov '14	Feb ’15	Mean	2006
TP	334	124.0	87.4	59.6	**151.3**	130
SRP	18.7	20.2	26.0	33.8	**24.7**	n/a
TN	2.46	1.25	1.23	1.29	**1.56**	1.3
TON	0.010	0.006	0.038	0.374	**0.107**	n/a
Nitrite	0.003	0.001	0.003	0.003	**0.002**	n/a
Chl *a*	36.74	0.88	13.42	3.30	**13.59**	21.90
DOC	12.1	13.5	13.3	11.2	**12.5**	n/a
pH	7.52	7.69	7.37	7.34	**7.48**	7.8
Alk	147	157	122	131	**139**	119.7
Cond	324	309	291	299	**306**	275
Ca2+	57.5	53.8	48.5	47.7	**51.9**	41.6
Mg2+	4.35	4.53	4.15	3.68	**4.18**	3.2
Na+	10.2	9.56	9.94	11.7	**10.35**	7.1
K+	2.76	3.18	4.56	3.07	**3.39**	3.1
Cl-	17.2	15.5	18.3	22.7	**18.4**	8.6
SO42-	10.1	5.21	17.6	13.7	**11.65**	13.0

Hydrology

Corraharra Lough receives its water from both Mill and Corracoash Loughs to the southwest. Between these loughs there are extensive areas of marshland / reedbed. Corraharra Lough drains to the north into Upper Lough Erne via outflow streams which pass through a further area of wet woodland and marshland. The hydrological regime at the site appears natural.

Lake substrate

The lake substrate is predominantly silty, which is consistent with the underlying geology and alluvial soils in the catchment.

Sediment load

There is very slight poaching of the lake shore, although its extent is minimised by the dense marginal vegetation. On either side of the track to the north east of the lake coniferous trees have been logged by the National Trust to allow natural regeneration of the woodland. The lake water was slightly turbid at the time of survey, as was in 2006 so perhaps this is an on-going issue at the Lough but it is uncertain whether this was a direct result of either poaching or logging. However, internally derived sedimentation is likely to be relatively high due to high nutrient loadings, which may in time reduce the extent of open water in what is already a very shallow water body.

Indicators of local distinctiveness

The aquatic macrophyte flora of Corraharra Lough is noteworthy due to the unusual abundance of *S. aloides*. Other notable species include *Sium latifolium*, a priority

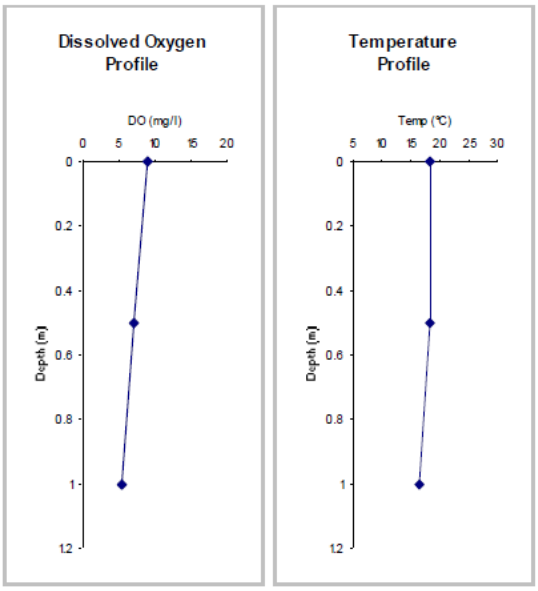
species for Northern Ireland. The marginal vegetation is of particular note for its species richness.

Figure 70 Dissolved oxygen and temperature profile for Corraharra Lough

Dissolved Oxygen Profile

GPS Location	H3561022710
Maximum Depth (m)	1.5 m
Secchi Depth (cm)	95 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.92	18.4
0.5	7	18.2
1	5.5	16.4



Summary

Corraharra Lough has a species rich submerged and floating leaved aquatic macrophyte flora both overall (16 species) and with respect to the representation of characteristic species (5 species). In 2006 using CSM guidance (JNCC, 2005) the lough was determined to be favourable with respect to the site's aquatic macrophyte flora. While this assemblage has change very little since then, the updated CSM guidance (JNCC, 2015) no longer recognises *Lemna* species as characteristic and therefore the total number of typical species drops below the requisite six. Despite a reasonable and stable aquatic assemblage, the lough is at considerable risk of deterioration due to high nutrient concentrations and potentially high internally derived sedimentation. Furthermore, the lough is connected to Corracoash Lough via a stream and an area of wetland. Corracoash Lough is similarly enriched, has very turbid water and may have seen the demise of broadleaved *Potamogeton* species from its aquatic plant assemblage. Diffuse pollution from surrounding farmland in the catchment may be contributing to the current high trophic status of both Corraharra and Corracoash Loughs. Diffuse sources of pollution should be investigated and monitored to ensure that Corraharra's diverse aquatic macrophyte assemblage is maintained.

The high nutrient concentrations place Corraharra Lough in **Unfavourable** condition and efforts to establish and control the source of the nutrients should be a priority for this site.

Table 354 Corraharra Lough: Overview

Water Body	Status	Reason(s) for Failure	Comments
Corraharra Lough NI Lake 1012	**Unfavourable**	High mean annual TP and TN concentrations. Seasonally high Chl *a.* Only 5 characteristic species present	5 characteristic species, including 1 broad-leaved *Potamogeton* spp. Excellent marginal / emergent flora. The lough is remarkable in hanging on to its characteristic flora despite being hyper-eutrophic. Efforts should be made to identify and control nutrient inputs to the site.

Species list

Table 355 List of all plant species recorded at Corraharra Lough

Marginal & Emergent species	Abundance (DAFOR)
Carex nigra	F
Carex acuta	F
Phragmites australis	O
Menyanthes trifoliata	O
Typha latifolia	O
Cicuta virosa	O
Sparganium erectum	O
Equisetum fluviatile	O
Iris pseudacorus	O
Carex rostrata	O
Galium palustre	O
Lythrum salicaria	O
Sium latifolium	O
Stachys palustris	O
Oenanthe fistulosa	O
Phalaris arundinacea	O
Mentha sp.	O
Filipendula ulmaria	O
Juncus effusus	O
Angelica sylvestris	O
Epilobium hirsutum	O
Lysimachia vulgaris	O
Lysimachia nummularia	O
Schoenoplectus lacustris	R
Alisma plantago-aquatica	R
Rumex hydrolapathum	R
Hydrocotyle vulgaris	R
Juncus acutiflorus	R
Alnus glutinosa	R
Potentilla palustris	R
Lotus pedunculatus	R
Scutellaria galericulata	R
Ranunculus flammula	R
Persicaria amphibia	R
Butomus umbellatus	R
Myosotis scorpioides	R
Valeriana officinalis	R
Stellaria palustris	R
Epilobium parviflorum	R
Epilobium palustre	R
Lychnis flos-cuculi	R
Utricularia vulgaris agg.	R

Submerged & floating species	% Frequency (n = 29)
Elodea canadensis	28
Hydrocharis morsus-ranae	40
Lemna minor	28
Lemna trisulca	28
Myriophyllum verticillatum	3
Nuphar lutea	93
Nymphaea alba	7
Potamogeton berchtoldii	+
Potamogeton obtusifolius	+
Potamogeton praelongus	28
Sparganium emersum	24
Spirodela polyrhiza	62
Stratiotes aloides	41
Utricularia vulgaris agg.	3

Survey Data

Site Condition Assessment: Corraharra Lough (05/07/2014)

Lake Details		**Survey Details**		
Lake Name	Corraharra Lough	Survey Date	05/07/2014	
SSSI Name & BG		Surveyors	SD & AH	
SAC Name	Upper Lough Erne	Shore Surveys	1	out of
Grid Ref (centre)	H356228	Wader Surveys	1	1
WBID / NI No.	0 / 1012	Boat Surveys	1	sections

Site Notes:

Survey Notes:
Site rather turbid with plants degraded. No Sag sag, pot prae relatively common in middle but degraded.

Section Summaries

Section 1	Maximum depth of colonisation (cm)	-
	Compass bearing of boat transect (°)	96 °
	Lateral distance from waters edge to 75cm depth (m)	10 m
	Notes: @ 25cm only emergents	

Section Locations

	Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
	start	end	start (shore)	end (lake)
Section 1	H3558422803	H3553422735	H3560622758	H3555022771

Section Photos

	Start of Section	Whole Section	End of Section
Section 1	0202	0203	0204

3.70. Castle Lough (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation

Survey Date	01 August 2014
NI Lake Number:	1026
WBID:	50045
County:	Fermanagh
Grid reference:	H408201
OS Grid reference (X,Y):	240894,320055
Shoreline development index:	2.15
Surface area (ha.):	13
Maximum recorded depth (m):	4

Table 356 Condition Assessment Summary Table for Castle Lough

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species including 1 broad-leaved *Potamogeton* spp.	✓	6 characteristic species present in 2014: *Chara globularis, Hydrocharis morsus-ranae, Potamogeton lucens*, *Potamogeton obtusifolius*, *Spirodela polyrhiza,* & *Utricularia sp.* (1 broad-leaved *Potamogeton* spp. – *P. lucens*).

Attribute	Target	Status	Comment
	No loss of characteristic species	**X**	*Potamogeton praelongus,* and *Stratiodes aloides* recorded in 2006, the latter also recorded in 1988. Neither observed on the 2014 survey.
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic spp.	**X**	55% of vegetated sample spots comply (67.5% wader, 40.5% boat)
Negative indicator species	Non-native species absent or present at low frequency	**X**	*Elodea canadensis* recorded at 36% of vegetated, submerged sample points. In 2006 the abundance of *E. canadensis* was higher, at 68%. Zebra mussels present.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	✓	1.3% of sampling sections scored a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Excellent marginal habitat dominated by reeds and sedges. Entire site fringed by *P. australis*, with *S. lacustris* & *E. fluviatile* (some *C. rostrata*) on the water side & *Carex paniculata,, Juncus effusus* and *Juncus articulatus* towards the shore. Numerous other emergent species: *Apium nodiflorum, Alisma plantago-aquatica, Cicuta virosa, Epilobium palustre, Menyanthes trifoliate, Oenanthe fistulosa* and *Sagittaria sagittifolia* the most abundant. Margins also herb-rich. Species rich submerged and floating leaved flora; *N. lutea* & *S. emersum* to ~1.6 m all over lough. *Myriophyllum verticillatum* and *Nitella flexilis* often occurring in large beds. *L. trisulca* common throughout.
	Maximum depth distribution should be maintained	**X**	Z_{max} (recorded) = 4 m, Z_s = 1.4 m, Z_v = >1.7 m.
	At least the present structure should be maintained	✓	Hydrosere present – no change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	✓	TP = 41.9 μgl^{-1} (range = 31-48) & TN = 0.97 mgl^{-1} (April '14 – Feb. '15)
	Stable pH / ANC values: pH >7.00 & <9.00.	✓	pH = 7.76 (range = 7.5 – 8.0)

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	✓	Waters well mixed and oxygenated throughout the water column: mean value of 7.9 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	No blooms present. Water clear.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of increased sediment loads but poaching observed on shoreline of S2.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	**X**	Particularly good site for *Sagittaria sagittifolia. Stratiotes aloides* recorded in 2006 but not in 2014.
	Minimal negative impacts and no fish farming	**X**	Zebra mussels present, but not abundant. Only recorded in S2. Poaching also observed in S2.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 13 ha, with no loss of extent of open water.

Macrophyte community composition

Castle Lough has a rich submerged and floating leaved aquatic macrophyte flora both overall (19 species) and with respect to the representation of characteristic species (6 species). The site also has a rich marginal and emergent flora (see following section). The total number of species recorded in 2014 was 48. The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 7.9 and 7.14 respectively (Table 357) and are marginally higher than the scores derived from the 2006 survey data (7.7 and 6.60 respectively) suggesting the site is moving towards a more eutrophic state. All characteristic species recorded in 1988 were also recorded in 2014, except *Stratiotes aloides*. Three species recorded in 2006, *P. praelongus*, *P. pusillus* and *S. aloides* were not observed in 2014. *P. berchtoldii* was gained in the recent survey however. The possible loss of a broadleaf pondweed species is of particular concern.

Negative indicator species

Elodea canadensis was recorded as abundant in 1988 (“3” on a 1-5 abundance scale) and in 2006 it was recorded at an overall abundance of 68%, suggesting that *E. canadensis* has been a significant component of Castle Lough’s aquatic macrophyte community for at least the last 26 years. Any self-sustaining population of a high-impact non-native species is considered unfavourable within the CSM guidance (2015). Zebra mussels were also recorded at the site. Although they were not abundant, their presence is of concern to the site condition.

Table 357 Aquatic macrophyte community composition for Castle Lough, including trophic scores.

Submerged and floating vegetation	2006 TRS	2006 PLEX	2006 % occurrence (n=74)*	2014 TRS	2014 PLEX	2014 % occurrence (n=77)*
Apium inundatum	7.0	7.50	+	-	-	-
Baldellia ranunculoides	-	-	5	-	-	-
Chara globularis	**8.5**	**7.69**	**+**	**8.5**	**7.69**	**5**
Eleocharis acicularis	8.5	7.95	5	-	-	-
Elodea canadensis	8.5	7.95	68	8.5	7.95	36
Fontinalis antipyretica	6.3	5.38	9	6.3	5.38	17
Hydrocharis morsus-ranae	**-**	**-**	**5**	**-**	**-**	**21**
Lemna minor	9.0	8.85	9	9.0	8.85	30
Lemna trisulca	10.0	8.85	69	10.0	8.85	66
Menyanthes trifoliata	-	-	1	-	-	1
Myriophyllum alterniflorum	5.5	4.23	+	-	-	-
Myriophyllum verticillatum	-	-	1	-	-	18
Nitella flexilis	-	-	-	5.5	5.38	18
Nitella flexilis agg.	-	-	-	5.5	5.38	6
Nitella mucronata	5.5	5.38	14	5.5	5.38	3
Nuphar lutea	8.5	6.92	78	8.5	6.92	53
Nymphaea alba	6.7	3.08	1	-	-	-
Potamogeton berchtoldii	-	-	-	7.3	7.69	9
Potamogeton lucens	**10.0**	**7.88**	**31**	**10.0**	**7.88**	**1**
Potamogeton natans	6.7	4.23	1	-	-	-
Potamogeton obtusifolius	**7.3**	**6.54**	**38**	**7.3**	**6.54**	**6**
Potamogeton pusillus	8.5	7.95	+	-	-	-
Potamogeton praelongus	**7.3**	**5.38**	**1**	**-**	**-**	**-**
Sagittaria sagittifolia	-	-	39	-	-	38
Sparganium emersum	10.0	7.50	57	10.0	7.50	44
Spirodela polyrhiza	**-**	**-**	**-**	**-**	**-**	**31**
Stratiotes aloides	-	-	42	-	-	-
Utricularia sp.	**5.5**	**4.23**	**12**	**5.5**	**4.23**	**17**
Average score	**7.7**	**6.60**		**7.9**	**7.14**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Castle Lough is bounded by mixed woodland along much of its eastern shore and by rough pasture to the north, south and west. Beyond this zone, the lough has an excellent marginal habitat, dominated by a wide range of emergent species including reeds and sedges. *Carex paniculata* was frequently encountered in the margins, growing alongside numerous other emergent species: *A. nodiflorum, A. plantago-aquatica, C. virosa, E. palustre, M. trifoliata, O. fistulosa* and *Sagittaria sagittifolia* being the most abundant. The margins are also incredibly herb-rich. *Scirpo-Phragmitetum* communities grow in a continuous band around much of the lake, comprising mainly *Phragmites australis* and *Schoenoplectus lacustris* and a local abundance of *Carex rostrata*. This community extends into water depths of greater

than 0.75 m, beyond which the open water plant community is dominated by the floating-leaved species; *Nuphar lutea* and *Sparganium emersum* to water depths of approximately 1.5 m in most areas of the lough. *Myriophyllum verticillatum* and *Nitella flexilis* were frequently encountered growing at high density in large beds in certain areas of the lough. *L. trisulca* was found in abundance throughout the lough, growing beyond a depth of 1.7 m, but being most common at water depths < 1.2 m. *E. canadensis* was most abundant at water depths of 1 – 1.3 m. *Nitella mucronata* and *N. flexilis* were found in the deeper waters of <1 m. A full species list is given in Table 360 below.

Water quality

Table 358 Water chemistry data for Castle Lough

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1988
TP	31.1	43.5	45.6	47.5	**41.9**	29.0	48
SRP	7.7	10.8	13.4	8	**10.0**	-	2
TN	0.75	0.77	1.34	1.02	**0.97**	1.03	1.27
TON	0.010	0.014	0.280	0.246	**0.138**	-	-
Chl *a*	5.61	4.29	2.75	5.17	**4.45**	4.20	24.3
DOC	11.50	10.60	13.20	11.40	**11.68**	-	-
pH	7.90	7.99	7.77	7.52	**7.76**	8.00	7.98
Alk	129	150	116	96	**123**	118	94.8
Cond	294	305	326	240	**291**	302	380
Ca^{2+}	50.2	49.0	51.6	38.5	**47.3**	49.5	63
Mg^{2+}	4.32	4.73	4.82	3.55	**4.36**	3.80	5.4
Na^{+}	9.39	11.10	12.40	8.88	**10.44**	8.80	4.75
K^{+}	2.91	2.34	4.08	2.59	**2.98**	2.30	1
Cl^{-}	17.90	19.60	23.20	17.10	**19.45**	9.60	17.9
$SO4^{2-}$	11.40	10.50	21.10	11.30	**13.58**	18.10	12.9

Castle Lough is a shallow (Z_{max} recorded = 4 m), eutrophic lake with a relatively high annual mean TP (42 μgl^{-1}) which although within the target limit for very shallow high alkalinity lakes (JNCC 2015), fall outside the acceptable limit for "good" status within the more stringent criteria set out UK WDF and WFD (Priority Substances and Classification) Regulations NI (WFD (NI) 2010). This represents an increase in TP since 2006 when it was recorded as 29 μgl^{-1}, which suggests that the lough is becoming more eutrophic. At the time of survey in August 2014, the upper 3.5 m of the water column was well oxygenated (7-9 mgl^{-1}) (Figure 71). There was no thermocline present.

Hydrology

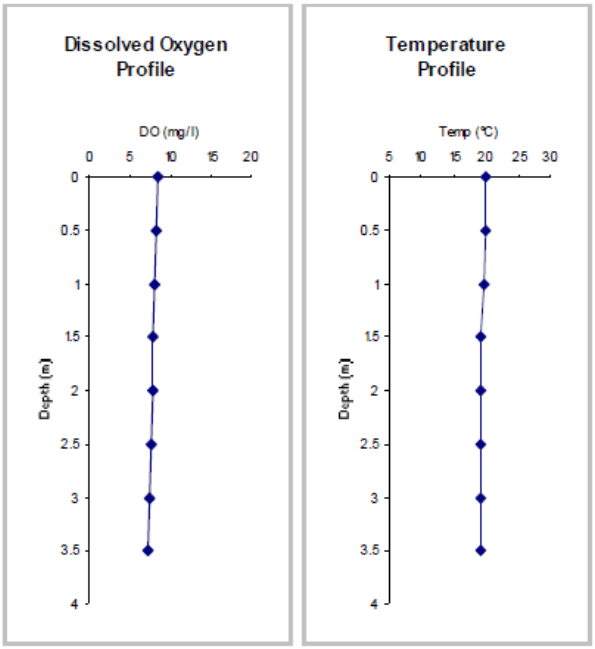
The inflow to Castle Lough is sourced from a series of smaller loughs and streams to the south. The lough drains to the north, flowing into the R. Finn channel via a short outflow stream. The hydrological regime at the site appears natural.

Figure 71 Dissolved oxygen and temperature profile for Castle Lough (01/08/2014)

Dissolved Oxygen Profile

GPS Location	H4093020142
Maximum Depth (m)	4 m
Secchi Depth (cm)	140 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.55	19.9
0.5	8.3	19.9
1	8.14	19.8
1.5	7.85	19.3
2	7.79	19.2
2.5	7.58	19.1
3	7.49	19.1
3.5	7.13	19.1



Lake substrate

Root mass predominates in the marginal areas to a water depth of ~75 cm. In deeper water areas the substrate predominantly comprises silts.

Sediment load

The entire lough has a reed and sedge dominated wetland fringe, which would reduce the impact of any increase in catchment sediment loads. At the time of survey the water clarity was good but there was evidence of livestock poaching in S2, on the northwest side of the lake.

Indicators of local distinctiveness

The diverse aquatic flora, inclusive of broadleaf pondweeds is of interest and management should be focused on preserving these.

Summary

Castle Lough supports a species rich submerged, floating-leaved and marginal aquatic macrophyte flora and is tentatively classified as being **favourable, at risk.** The frequency of the non-native species, *E. canadensis* has decreased since 2006 but should be monitored to ensure that its population either remains stable or continues to decrease. The characteristic eutrophic flora and acceptable trophic status are considered adequate to place the site in favourable condition, but evidence for possible deterioration since 2006 places it as being at risk. Three species recorded in 2006, *P. praelongus, P. pusillus* and *S. aloides* were not observed in 2014. *P. berchtoldii* was gained in the 2014 survey however. Further survey work is required to assess if these species have been lost from the site, or are simply outside the survey sections.

The water quality data, although favourable, suggests that TP concentrations are increasing, and should therefore be monitored regularly and any potential sources within the catchment investigated.

The presence of zebra mussels is inevitable given the proximity to Upper Lough Erne. Castle Lough is therefore determined to be in **favourable, at risk** status.

Table 359 : Castle Lough: Overview

Water Body	Status	Reason(s) for Failure/concern	Comments
Castle Lough NI Lake 1026	**Favourable, at risk**	TP has increased since 2006. No *P. praelongus* recorded Zebra mussels present, but rare.	Aquatic macrophyte flora is species rich and appears stable since 1988. Moderate frequency of *E. canadensis* may not be detrimental to overall site condition. Nutrient concentrations have remained relatively stable since 1988, although TP appears to be increasing.

Species list

Table 360 List of all plant species recorded at Castle Lough.

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	O
Caltha palustris	R
Carex paniculata	R
Carex rostrata	R
Cicuta virosa	R
Elodea canadensis	F
Epilobium palustre	R
Epilobium parviflorum	R
Equisetum fluviatile	R
Galium palustre	R
Hydrocotyle vulgaris	R
Iris pseudacorus	R
Juncus articulatus	R
Juncus effusus	F
Lysimachia nummularia	R
Lysimachia vulgaris	R
Lythrum salicaria	R
Mentha aquatica	F
Mentha sp.	F
Menyanthes trifoliata	R
Myosotis scorpioides	R
Oenanthe fistulosa	R
Phragmites australis	F
Potentilla anserina	F
Ranunculus flammula	R
Rumex hydrolapatham	R
Schoenoplectus lacustris	A
Senecio aquaticus	O
Sium latifolium	R
Sparganium emersum	F
Sparganium erectum	R

Submerged & floating species	% Frequency (n = 77)
Chara globularis	5
Elodea canadensis	36
Fontinalis antipyretica	17
Hydrocharis morsus-ranae	21
Lemna minor	30
Lemna trisulca	66
Myriophyllum verticillatum	18
Nitella flexilis	18
Nitella flexilis agg.	6
Nitella mucronata	3
Nuphar lutea	53
Potamogeton berchtoldii	9
Potamogeton lucens	1
Potamogeton obtusifolius	6
Sagittaria sagittifolia	38
Sparganium emersum	44
Spirodela polyrhiza	31
Utricularia sp.	17

Survey data

Site Condition Assessment: Castle Lough (01/08/2014)

Lake Details		**Survey Details**		
Lake Name	Castle Lough	Survey Date	01/08/2014	
SSSI Name		Surveyors	SG, EF	
SAC Name		Shore Surveys	2	out of
Grid Ref (centre)	H409201	Wader Surveys	2	2
WBID / NI No.	50045 / 1026	Boat Surveys	2	sections

Site Notes:

Survey Notes:
Zebra mussels present in section 2

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	315 °
		Lateral distance from waters edge to 75cm depth (m)	15 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	30 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H4111520415	H4119820479	H4115820450	H4118120346
Section	**2**	H4057419726	H4048619693	H4053119726	H4055519658

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	129-0373	129-0374	129-0375
Section	**2**	129-0371	129-0368	129-0369

3.71. Lough Sarah (HA, VSh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation

Survey Date	02 August 2014
NI Lake Number:	1027
WBID:	50332
County:	Fermanagh
Grid reference:	H424197
OS Grid reference (X,Y):	242406,319678
Shoreline development index:	1.354
Surface area (ha.):	1.6
Maximum recorded depth (m):	1.4 m

Table 361 Condition Assessment Summary Table for Lough Sarah

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species and 1 broad-leaved *Potamogeton* spp.	✓	4 characteristic species present in 2014: *Hydrocharis morsus-ranae, Potamogeton lucens, Potamogeton obtusifolius* and *Spirodela polyrhiza* 1 broadleaved *Potamogeton* sp. recorded (*P. lucens)*
	No loss of characteristic species	**X**	*U. vulgaris* agg. recorded in 2006 but not 2014.

Attribute	Target	Status	Comment
	≥ 6/10 vegetated sample spots (boat and wader survey) have ≥ 1 characteristic species	✓	63% of vegetated sample spots comply (89% wader, 40% boat)
Negative indicator species	Non-native species absent or present at low frequency.	**X**	*Elodea canadensis* recorded at 89% of vegetated, submerged sample points.
	Filamentous Algae (non-*Chara*): <20% of points scoring '3'	**X**	Cover of filamentous algae moderate to high with 30% of sampling points with a cover value of '3'
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Excellent marginal habitat dominated by reeds and sedges. Entire site fringed by *P. australis*, with *S. lacustris* and *S. erectum.* , Dominant emergent species are *E. fluviatile, S. aloides* (25-120 cm depth) and *M. trifoliata*. Margins herb-rich. Species rich submerged and floating leaved flora: *Myriophyllum verticillatum* generally in shallow water (25-75 cm). *E. canadensis* abundant from 25-140 cm, intermingled with *L. trisulca. N. lutea* found in deeper waters, from 50-130 cm, with *N. alba* on the outer edge at 130-140 cm. *P. obtusifolius* recorded in this zone at 120-130 cm. *Nitella sp.* and *S. emersum* found throughout the whole range of depths (25-140 cm). *P. lucens* found only at 130 cm at N end of lough.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 1.4 m, Z_s = 1.05 m, Z_v = >1.4 m
	At least the present structure should be maintained	✓	Hydrosere present – no change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 50 μgl^{-1}	**✓?**	TP = 50 μgl^{-1} (range = 32-89 μgl^{-1}) & TN = 0.9 mgl^{-1} (range = 0.8-1.0 mgl^{-1}). (April '14 – Feb. '15)
	Stable pH / ANC values: pH >7.00 & <9.00; ANC > 20 μeql^{-1}	✓	pH = 7.6 (range = 7.6 – 7.7)

Attribute	Target	Status	Comment
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline)	✓	Water column well mixed and oxygenated throughout: mean value of 7.57 mgl^{-1}
	No excessive growth of cyanobacteria or green algae	✓	No cyanobacteria bloom present.
Hydrology	Natural hydrological regime	✓	Appears natural.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No direct evidence of increased sediment loads. No grazing / poaching observed.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	*Sium latifolium* (Priority species) recorded in 2006 but not 2014. Probably overlooked.
	Minimal negative impacts and no fish farming	✓	No grazing or poaching impacts observed.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.6 ha, with no loss of extent of open water.

Macrophyte community composition

Overall, Lough Sarah has a relatively rich submerged and floating leaved aquatic macrophyte flora (16 species), but only four of these are characteristic eutrophic species (inclusive of one broad-leaved *Potamogeton* spp., *Potamogeton lucens*). In total, 63% of the survey points did however have one or more characteristic species. A further 24 species of marginal and emergent plants were recorded growing on the lough shore in a wetland habitats that surround the site.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site were 8.4 and 7.18 respectively (Table 362), which is a slight increase on the scores from the 2006, but a decrease of the TRS and PLEX scores calculated from the 1989 survey (8.8 and 7.20) are slightly lower, which suggests an improvement in trophic status over the past 25 years. Species composition varies somewhat between the three separate surveys. All submerged/floating taxa recorded in 2006 were also recorded in 2014, except for *Utricularia vulgaris* agg., which appeared to be absent from the surveyed sections. Three species were recorded in 2014, but not in 2006: *Myriophyllum spicatum, Myriophyllum verticillatum* and *Nitella* sp. The latter species was recorded with a frequent abundance of 39.4%. The 2006 survey observed a significant decline in the population of *P. lucens* since 1989, when it was recorded as dominant ("5" on a 1-5 scale). This species has remained rare in the lough since 2006, having been recorded only once with a "1" (on a 1-3 scale) on the recent survey.

Negative indicator species

Elodea canadensis was recorded as frequent in 1989 ("3" on a 1-5 abundance scale). In 2006 it was recorded at an overall frequency of 47%, while in 2014 its overall frequency rose to 89%, immediately placing Lough Sarah under unfavourable status with respect to non-native species. The coverage of filamentous algae was relatively high in places with 30% of sampling points having a cover value of '3', further suggesting that the site is in unfavourable condition.

Table 362 Aquatic macrophyte community composition for Lough Sarah, including trophic scores

	2006			2014		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=30)***	**TRS**	**PLEX**	**% occurrence (n=38)***
Elodea canadensis	8.5	7.95	47	8.5	7.95	89.5
Hydrocharis morsus-ranae	**-**	**-**	**13**	**-**	**-**	**23.7**
Lemna minor	9.0	8.85	13	9.0	8.85	55.3
Lemna trisulca	10.0	8.85	47	10.0	8.85	63.2
Myriophyllum spicatum	-	-	-	10.0	8.85	15.8
Myriophyllum verticillatum	-	-	-	-	-	21.1
Nitella sp.	-	-	-	5.5	5.38	39.5
Nuphar lutea	8.5	6.92	43	8.5	6.92	73.7
Nymphaea alba	6.7	3.08	7	6.7	3.08	7.9
Potamogeton lucens	**10.0**	**7.88**	**+**	**10.0**	**7.88**	**2.6**
Potamogeton obtusifolius	**7.3**	**6.54**	**+**	**7.3**	**6.54**	**13.2**
Sagittaria sagittifolia	-	-	27	-	-	52.6
Sparganium emersum	10.0	7.50	27	10.0	7.50	60.5
Spirodela polyrhiza	**-**	**-**	**7**	**-**	**-**	**47.4**
Stratiotes aloides	-	-	50	-	-	15.8
***Utricularia vulgaris* agg.**	**5.5**	**4.23**	**53**	**-**	**-**	**-**
Average score	**8.4**	**6.87**		**8.6**	**7.18**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

Macrophyte community structure

Lough Sarah is bounded by areas of wet woodland both to the west and along part of the northern shore. There is an area of wet meadow along the remainder of the northern shore. Beyond this zone the lough has a species rich reed and sedge dominated marginal habitat. This is for the most part narrow and continuous, widening along the north-eastern shore to approximately 60 m wide. The entire site is fringed by *Phragmites australis*, with *Schoenoplectus lacustris* and *Sparganium erectum.* The dominant emergent species include *Equisetum fluviatile, Stratiotes aloides* (25-120 cm depth) and *Menyanthes trifoliata*. The margins are also herb-rich. The submerged and floating leaved flora is similarly species rich, with *Myriophyllum verticillatum* generally growing in shallower water at a depth between 25 – 75 cm.

Elodea canadensis and *Lemna trisulca* was found to be growing abundantly between 25 – 140 cm; the extent of *E. canadensis* appears much greater than in 2006, when it was recorded to only be growing in regions of < 1.0 m. *Nuphar lutea* was recorded in deeper waters, between 50 – 130 cm, with patches of *Nymphaea alba* found to be growing on the outer edge at depths of 130 – 140 cm at the northern end of the lough. *Potamogeton obtusifolius* was also recorded in this zone (120 – 130 cm). *Nitella sp.* and *Sparganium emersum* were found throughout the entire range of depths, while *Potamogeton lucens* was only found with an abundance of '1' (on a 1-3 scale) once at a depth of 130 cm. A full species list is given in Table 365 below.

Water quality

Lough Sarah is a very shallow (Z_{max} recorded = 1.4 m), eutrophic lake with moderate annual mean TP (50 μgl^{-1}) which classifies it as borderline "favourable" with respect to trophic status according to CSM guidelines (JNCC 2015). This is an improvement to 2006, when Lough Sarah was classified as "unfavourable" with a mean annual TP of 61 μgl^{-1}. TN concentrations are almost identical to those recorded in 2006, with an average annual mean of 0.9 mgl^{-1}. This has remained fairly consistent throughout the year, with a range of 0.8-1.0 mgl^{-1}. Chl *a* concentrations are low for most of the year, only increasing in spring. At the time of survey in July 2014, the filamentous algal cover scores were moderate to high, suggesting nutrient enrichment. The entire water column was well mixed and oxygenated with a mean value of 7.57 mgl^{-1} (Figure 72).

Table 363 Water chemistry data for Lough Sarah

	Apr. '14	Aug. '14	Nov. '14	Feb. '15	Mean	2006	1989
TP	34.1	89.1	44.3	32.1	**49.9**	61.0	49
SRP	8.7	16.5	19.3	14.7	**14.8**	-	6
TN	0.79	0.80	1.04	0.98	**0.90**	0.98	1.52
TON	0.005	0.005	0.2	0.326	**0.134**	-	-
Nitrite	0.002	0.001	0.012	0.004	**0.005**	-	-
Chl a	13.97	16.28	3.41	0.61	**8.57**	7.00	10.08
DOC	9.21	10.10	9.86	9.14	**9.58**	-	-
pH	7.74	7.56	7.56	7.64	**7.62**	7.80	7.94
Alk	109	118	111	84	**105**	104	67.0
Cond	247	250	262	220	**245**	262	303
Ca^{2+}	36.60	38.70	43.20	31.90	**37.60**	42.70	41.6
Mg^{2+}	3.88	4.32	4.35	3.48	**4.01**	3.50	5.4
Na^{+}	9.06	9.42	9.63	9.80	**9.48**	8.90	5.7
K^{+}	2.59	3.28	3.23	2.90	**3.00**	3.20	0.35
Cl^{-}	18.10	16.50	17.00	18.20	**17.45**	10.40	18.2
SO_4^{2-}	<10	7.17	11.80	7.86	**9.21**	18.90	13.5

Hydrology

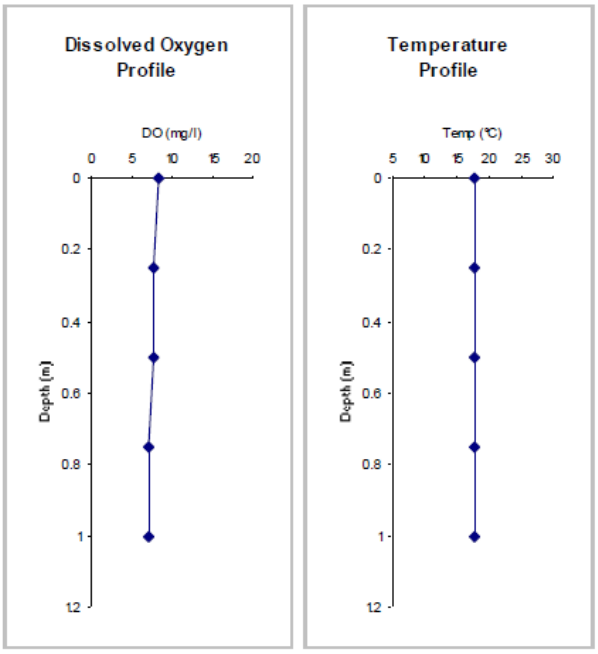
The inflow to Lough Sarah is sourced from a series of loughs and streams to the south. The lough drains to the north via a short outflow stream, flowing into the R. Finn channel and subsequently into Upper Lough Erne. The hydrological regime at the site appears natural.

Figure 72 Dissolved oxygen and temperature profile for Lough Sarah (02/08/2014)

Dissolved Oxygen Profile

GPS Location	H4244519660
Maximum Depth (m)	1.2 m
Secchi Depth (cm)	105 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.25	17.8
0.25	7.7	17.8
0.5	7.8	17.8
0.75	7.1	17.8
1	7	17.8



Lake substrate

At water depths of <75 cm areas of root mass are common. Beyond this water depth the substrate consists entirely of silts.

Sediment load

Lough Sarah has a reed and sedge dominated wetland fringe, which is for the most part narrow. There is an area of wet woodland to the west and wet meadow lies along part of the northern shore with areas of pasture. No evidence for poaching was observed at the time of survey.

Indicators of local distinctiveness

Sium latifolium was recorded in 2006 but not in 2014 (almost certainly overlooked). It is listed as a “priority species” for Northern Ireland, being confined to the Lough Erne basin in County Fermanagh (www.habitas.org.uk, 2007).

Summary

Lough Sarah supports a species rich submerged, floating-leaved and marginal aquatic macrophyte flora, with four characteristic species represented, including the broad-leaved *Potamogeton* spp., *P. lucens*. In total, 63% of the survey points had at least one characteristic species, although many of these points can be attributed to the presence of *S. polyrhiza.* The species assemblage is similar to that recorded in 2006, although *Utricularia vulgaris* was absent from the 2014 survey.

Despite being relatively species rich, the flora is dominated by species tolerant of eutrophic conditions and the lack of characteristic species and rarity of *P. lucens* suggests the site is in decline. In addition, there was a moderate to high abundance of filamentous algae and an extremely high abundance of the non-native species, *E. canadensis,* which was recorded at >50 % frequency overall. Therefore the site is classified as being in **unfavourable** condition overall and at risk of further decline due to eutrophication.

Total phosphorus concentrations were right on the upper limit for this site type and although slightly lower than the mean value in 2006, need to come down more to facilitate recovery at the site. It is recommended that nutrient concentrations are monitored and potential nutrient sources identified and managed, with the aim of minimising the risk of deterioration in Lough Sarah's condition.

Table 364 Lough Sarah: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lough Sarah NI Lake 1027	**Unfavourable**	Only 4 characteristic species recorded *High frequency of Elodea canadensis* High cover of filamentous algal abundance. TP levels are borderline favourable.	Aquatic macrophyte flora is species rich and although some species have remained relatively stable since 1989 – there appears to have been a significant decrease in the abundance of *P. lucens.* Recommended that nutrients be monitored and where possible, inputs controlled.

Species list

Table 365 List of all plant species recorded at Lough Sarah: 2014

Marginal & Emergent species	Abundance (DAFOR)
Alnus glutinosa	R
Angelica sylvestris	R
Berula erecta	O
Butomus umbellatus	O
Caltha palustris	O
Carex sp.	R
Equisetum fluviatile	O
Iris pseudacorus	R
Lycopus europaeus	O
Lysimachia vulgaris	R
Lythrum salicaria	R
Mentha aquatica	O
Menyanthes trifoliata	F
Myosotis scorpioides	R
Phalaris arundinacea	O
Phragmites australis	O
Ranunculus lingua	O
Rumex aquaticus	R
Schoenoplectus lacustris	O
Scutellaria galericulata	R
Sparganium emersum	F
Sparganium erectum	O
Stachys sylvatica	R
Typha latifolia	R

Submerged & floating species	% Frequency (n = 38)
Elodea canadensis	89
Hydrocharis morsus-ranae	24
Lemna minor	55
Lemna trisulca	63
Myriophyllum spicatum	16
Myriophyllum verticillatum	21
Nitella sp.	40
Nuphar lutea	74
Nymphaea alba	8
Potamogeton lucens	3
Potamogeton obtusifolius	13
Sagittaria sagittifolia	53
Sparganium emersum	61
Spirodela polyrhiza	47
Stratiotes aloides	16

Survey data

Site Condition Assessment: Sarah Lough (02/08/2014)

Lake Details		**Survey Details**	
Lake Name	Sarah Lough	Survey Date	02/08/2014
SSSI Name		Surveyors	SG, EF
SAC Name		Shore Surveys	1 out of
Grid Ref (centre)	H424197	Wader Surveys	1 1
WBID / NI No.	50332 / 1027	Boat Surveys	1 sections

Site Notes:

Survey Notes:

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	-
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	0.5 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H4235519814	H4241219744	H4238819772	H4234519732

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	130-0375	130-0379	130-0377

3.72. Lurgan Lough Upper (MA Sh)

Annex 1 type: H3150: Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation.

Survey Date	19 June 2015
NI Lake Number:	1192
WBID:	50648
County:	Armagh
Grid reference:	H950156
OS Grid reference (X,Y):	295012,315641
Shoreline development index:	1.092
Surface area (ha.):	1.5
Maximum recorded depth (m):	4.5

Table 366 Condition Assessment Summary Table for Lurgan Lough Upper

Attribute	Target	Status	Comment
Extent	No loss of extent of standing water	✓	
Macrophyte community composition	≥ 6 characteristic species & 1 broad-leaved *Potamogeton* spp.	**X**	3 present: *Potamogeton alpinus, P. obtusifolius* and *Utricularia australis*. The latter 2 rare within the site.

Attribute	Target	Status	Comment
	No loss of characteristic species	**X?**	*Callitriche* sp. was recorded in the 1990 survey but not observed in 2006 or 2015. No loss of characteristic species since 2006.
	≥ 6/10 vegetated sample spots (boat or wader survey) have ≥ 1 characteristic species	**X?**	53 % of vegetated sample spots comply. This is a marked increase due to *P. alpinus* being added to the CSM in 2015
Negative indicator species	Negative indicator species absent or at a low frequency	✓	None observed.
	Non-native species absent or present at low frequency	✓	None observed.
	Filamentous algae (non-*Chara*): <20% of points scoring '3'	✓	Generally low. Median cover score = 1 and overall cover <10%.
Macrophyte community structure	Characteristic vegetation zones should be present (site specific)	✓	Extensive wetland fringe with species rich margins dominated by *Typha latifolia*, *M. trifoliata, C. rostrata* and *E. fluviatile*. *P. alpinus* common from 0.75 to 1.8 m. *N. lutea* (0.50 – 2.2 m) and N. alba (1.0 – 2.1 m) found throughout site up to 2.3 m depth, beyond which the open water is turbid without vegetation.
	Maximum depth distribution should be maintained	✓	Z_{max} (recorded) = 4.30 m; Z_s =1.90 m; Z_v = 2.20 m.
	At least the present structure should be maintained	✓	No change evident
Water quality	Stable nutrients levels appropriate to lake type. TP target / limit = 35 µgl-1	✓	TP = 27.5 μgl^{-1} (18–32 μgl^{-1}) & TN = 1.2 mgl^{-1} Based on 3 values Nov'14 – Apr'15
	Stable pH / ANC values: pH >7.00 & <9.00	✓	pH = 7.25 (range = 7.04 – 7.46)
	Adequate dissolved O_2 throughout the water column (mean > 6 mgl^{-1} below thermocline	**X**	Well oxygenated in the upper 2.5 m with DO 9 mgl^{-1} at the surface, reducing to 0.6 mgl^{-1} at 4 m depth.
	No excessive growth of cyanobacteria or green algae	✓	No blooms present during sampling, but water with some algal turbidity noted
Hydrology	Natural hydrological regime	✓	Appears natural and well connected through the hydrosere to surrounding area.
Lake substrate	Natural shoreline maintained	✓	Natural shoreline maintained.

Attribute	Target	Status	Comment
	Natural and characteristic substrate maintained	✓	No evidence of change.
Sediment load	Natural sediment load maintained	✓	No evidence of significantly increased sediment loads.
Indicators of local distinctiveness	Distinctive elements maintained at current extent/levels and/or in current locations	✓	None specified.

Status: ✓ = favourable; X = unfavourable; - = unable to assess

Extent

The surface area of the lake is 1.5 ha, with no loss of extent of open water.

Macrophyte community composition

Lurgan Lough Upper supports three characteristic species: *Potamogeton alpinus (*added as characteristic in 2015*), Utricularia australis* and *P. obtusifolius.* The latter species were both rare, but *P. alpinus* was present throughout the site growing mainly in a zone from 0.75 to 1.3 m, but extending occasionally to 1.8 m and also present in the shallows near the road. A total of 53 % of vegetated plots contained one or more characteristic species. Six other aquatic species were recorded (Table 367), with white and yellow water lilies comprising the most abundant species growing around most of the lough to 2.2 m and *Potamogeton natans* recorded mainly from sheltered areas at the reed edge in section 2 . *Eleogiton* (*Isolepis*) *fluitans* and *Lemna minor* were rare and recorded only as strandline material. *Potamogeton polygonifolius* was recorded only from isolated pools in the margins.

Table 367 Aquatic macrophyte community composition for Lurgan Lough Upper, including trophic scores.

	2006			2015		
Submerged and floating vegetation	**TRS**	**PLEX**	**% occurrence (n=53)***	**TRS**	**PLEX**	**% occurrence (n=57)***
Apium inundatum	7.0	7.5	+			-
Eleogiton fluitans			-	4.0	3.08	+
Lemna minor			-	9.0	8.85	+
Nuphar lutea	8.5	6.92	38	8.5	6.92	78.9
Nymphaea alba	6.7	3.08	56	6.7	3.08	71.9
Potamogeton alpinus	**5.5**	**5.38**	**29**	**5.5**	**5.38**	**50.9**
Potamogeton natans	6.7	4.23	7	6.7	4.23	8.8
Potamogeton obtusifolius			**-**	**7.3**	**6.54**	**1.8**
Potamogeton polygonifolius			-	3.0	3.08	+
Utricularia australis	**5.5**	**4.23**	**4**	**5.5**	**4.23**	**+**
Average score	**6.7**	**5.22**		**6.2**	**5.04**	

* Based on presence / absence data from all vegetated plots in the wader and boat based surveys

The site was surveyed in 1990 (NILS) and overall the flora was similar to that recorded in 2006 and 2015. *P. alpinus* was possibly less abundant ("2" on a 1-5 scale), and *P. natans* more common ("4"), but there were no other characteristic species recorded. *Sparganium emersum* was however common in 1990 ("3"), but not recorded in either of the more recent surveys. Interestingly, *Nymphoides peltata* was also recorded in 1990, this species is outside its native range in Northern Ireland (Preston and Croft 1997) and its introduction to this site was most likely as a result of the very close proximity to the road. It has not persisted at the site.

The mean Trophic Rank Score (TRS, Palmer, 1992) and PLEX score (Duigan 2006) of the site was 6.2 and 5.04 respectively which is slightly lower than the 2006 scores due mainly to the presence of low scoring species *Eleogiton* (*Isolepis*) *fluitans* and *P. polygonifolius,* both with were confined to more acid pools in marginal wetlands and thus not representative of open water.

Negative indicator species

There were no negative indicator species and filamentous algal cover was relatively low. No survey points received cover scores of 3.

Macrophyte community structure

Lurgan Lough Upper lies within an extensive wetland area grading into moorland with rough and improved pasture dominating the catchment *Salix* scrub is interspersed within an extensive wetland fringe on the northern side with *C. rostrata, Juncus effusus, Potentilla palustris* and *Menyanthes trifoliata* commonly occurring. The boggy area to the northwest contains *Euphrasia anglica, Eleogiton fluitans* and *Utricularia australis* in the pools. The lough margins are dominated by *Typha latifolia, C. rostrata, Juncus* spp. and *Equisetum fluviatile*. In open water, *Potamogeton alpinus* was more common than in 2006 and occurred throughout most of the lough at depths of 0.75 to 1.3 m, occasionally in deeper water and in the shallows near the road is common at 0.25 – 0.75 m on the south side and occurred in isolated stands on the northeast and eastern shores. *P. natans* occurred only sparsely in section 1 within *N. lutea* beds. Most of the site was fringed with water lilies with *N. lutea* and *N. alba* forming mixed beds in places to 2.2 m. Beyond this depth the open water was relatively turbid and without submerged aquatic macrophytes.

Water quality

Lurgan Lough Upper has a relatively low annual mean TP (27.5 μgl^{-1}) which classifies it as "favourable" with respect to trophic status and places it within the "high" ecological status for this lake type under the more stringent criteria set by the UK WFD TAG reports (2006). Confidence in the TP data is slightly compromised by the lack of a summer water sample, but the spring values (31.8 μgl^{-1}) suggest the data to be representative and the mean value is similar to the results from 2006 (annual mean TP 23.3 μgl^{-1}) and the spot water sample recorded 0n the 14/06/1990 (26 μgl^{-1}) (Table 253). The mean chlorophyll *a* concentration based on the 3 values was 6.9 (range 4.7 – 9.2 μgl^{-1}) is well within the acceptable limit suggested for 'good' status for this lake type (23 μgl^{-1} has been suggested as the upper limit for Chl *a* in HA VSh lakes (Phillips 2006) and although summer values may have increased the mean slightly, a Secchi depth of 1.9 m is good for a eutrophic site. Total nitrogen and available oxidised nitrogen concentrations were within CSM guidelines (upper limit

for TN of 1.5 mgl^{-1}, JNCC 2015) The upper water column was well oxygenated, declining to 0.6 mgl^{-1} below 2.5 m (Figure 73).

Table 368 Water chemistry data for Lurgan Lough Upper

	Nov '14	Feb'15	Apr'15	Mean	2006	1990
TP	32.2	18.5	31.8	**27.5**	23.3	26
SRP	5.7	3.5	1.8	**3.7**		8
TN	1.330	1.350	0.900	**1.193**	1.1	1.11
TON	0.390	0.670	0.064	**0.375**	0.02	-
Nitrite	0.006	0.003	0.002	**0.004**		
Chl a	4.7	6.7	9.2	**6.9**	7.3	11.1
DOC	10.4	8.1	8.3	**8.9**		
pH	7.04	7.46	7.38	**7.25**	7.4	7.54
Alk	40	36	44	**40**	43.7	38.8
Cond	136	134	134	**135**	150	169
Ca^{2+}	15.9	15.1	15.6	**15.5**	20.1	15.0
Mg^{2+}	3.0	2.9	2.9	**2.9**	2.4	2.8
Na^{+}	7.6	7.4	7.7	**7.6**	6.9	8.4
K^{+}	3.2	2.9	2.5	**2.8**	1.8	1.2
Cl^{-}	14.6	13.3	14.4	**14.1**	7.8	17.0
SO_4^{2-}	10.4	12.2	10.8	**11.1**	12.1	13.6

Hydrology

Lurgan Lough Upper drains through marshland to the south. The hydrological regime at the site appears natural.

Lake substrate

The lake substrate is predominantly silty which is consistent with the catchment geology and land use.

Sediment load

Although much of the immediate lake catchment is improved or semi-improved grazing, the lough has an extensive area of wetland buffer and there is no evidence of increased sediment loading.

Indicators of local distinctiveness

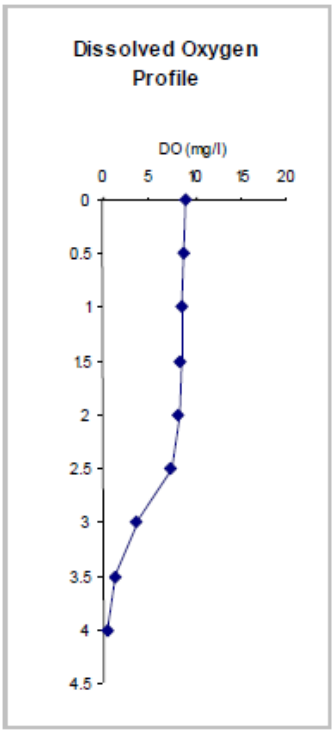
The primary conservation interest is the marginal fen and wetlands which represents some of the best habitat of its type within South Armagh.

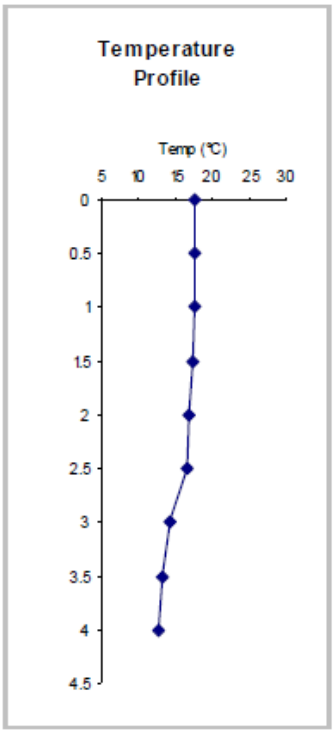
Figure 73 Dissolved oxygen and temperature profile for Lurgan Lough Upper (19/06/2015)

Dissolved Oxygen Profile

GPS Location	H9501015649
Maximum Depth (m)	4.3 m
Secchi Depth (cm)	190 cm
Notes:	

Depth (m)	DO (mg/l)	Temp (°C)
0	8.99	17.6
0.5	8.86	17.6
1	8.7	17.5
1.5	8.45	17.3
2	8.25	16.8
2.5	7.48	16.5
3	3.72	14.3
3.5	1.42	13.2
4	0.63	12.8





Summary

Following the 2006 survey the site was classified as unfavourable due to having only one characteristic eutrophic species (*U. australis*). No *P. obtusifolius* was recorded in 2006 and *P. alpinus* was not included as a characteristic species in the 2005 CSM guidance (JNCC 2005). The subsequent inclusion of *P. alpinus* in the 2015 CSM elevates the status of the site considerably, but despite 53% of vegetated plots now having one or more characteristic species it still fails to attain an adequate flora to be classified as favourable.

Despite lying within a catchment with improved pasture, the water quality at Lurgan Lough Upper is relatively good for a “natural eutrophic lough” and has favourable water quality with low mean annual TP, TN and Chl *a* concentrations (JNCC 2015). The good quality is likely to be due in part to the extensive wetland ‘buffer’, which itself forms excellent habitat and is of high conservation value. The aquatic flora is nonetheless below the expectation for this lake type and the site is therefore classified as **unfavourable**. No evidence of direct nutrient inputs was observed, but nearby dwellings and proximity to the road are potential sources and remain a potential threat to the site. Agriculture improvements at a catchment scale may also have contributed to the enrichment of the site over a longer time period resulting in species loss from open water. Alternatively, the site may always have been relatively species poor, and ASSSI assessment would therefore benefit from the setting of site specific species targets determined from older historic records (if they exist) and palaecological analysis of plant macrofossils in the lough sediments.

Table 369 Lurgan Lough Upper: Overview

Water Body	Status	Reason(s) for Failure	Comments
Lurgan Lough Upper NI Lake 1192	**Unfavourable**	Only 3 characteristic species present in 20015. 53% of vegetated plots contained one or more characteristic species	The site has remained relatively stable in terms of bother flora and water quality. Although the aquatic flora falls below CSM targets, the extensive wetland flora is excellent. A better understanding of the botanical history would allow site specific targets to be defined.

Species list

Table 370 List of all plant species recorded at Lurgan Lough Upper: 2015

Marginal & Emergent species	Abundance (DAFOR)
Alisma plantago-aquatica	R
Angelica sylvestris	R
Caltha palustris	O
Cardamine pratensis	O
Carex curta	R
Carex echinata	R
Carex nigra	O
Carex panicea	R
Carex rostrata	F
Eleocharis palustris	R
Epilobium palustre	O
Equisetum fluviatile	F
Eriophorum latifolium	R
Euphrasia anglica	R
Galium palustre	O
Hydrocotyle vulgaris	R
Juncus articulatus	F
Juncus effusus	F
Lotus pedunculatus	R
Menyanthes trifoliata	F
Mosses unid	O
Myosotis laxa	R
Potentilla erecta	R
Potentilla palustris	O
Ranunculus flammula	R
Salix sp.	F
Succisa pratensis	R
Typha latifolia	A
Veronica anagallis-aquatica	R
Veronica scutellata	R
Submerged & floating species	**% Frequency (n = 57)**
Eleogiton fluitans	+
Lemna minor	+
Nuphar lutea	79
Nymphaea alba	72
Potamogeton alpinus	51
Potamogeton natans	9
Potamogeton obtusifolius	2
Potamogeton polygonifolius	+
Utricularia australis	+

Survey data

Site Condition Assessment: Lurgan Lough Upper (19/06/2015)

Lake Details		**Survey Details**		
Lake Name	Lurgan Lough Upper	Survey Date	19/06/2015	
SSSI Name		Surveyors	BG & MST	
SAC Name		Shore Surveys	2	out of
Grid Ref	H950156	Wader Surveys	2	2
WBID / NI No.	50648 / 1192	Boat Surveys	2	sections

Site Notes:
Extensive wetland around western margins. Mainly rough grazing in immediate catchment, but some improved pasture also

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Survey Notes:
Many small pools within the wetland to west of site With Utricularia sp. and Eleogiton fluitans. Rich marginal wetland flora
Previous record for Apium inundatum - not recorded in 2015. No Chara recorded.

Section Summaries

Section	**1**	Maximum depth of colonisation (cm)	210 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	10 m
		Notes:	
Section	**2**	Maximum depth of colonisation (cm)	220 cm
		Compass bearing of boat transect (°)	-
		Lateral distance from waters edge to 75cm depth (m)	5 m
		Notes:	

Section Locations

		Shore Survey GPS Co-ords		Boat Survey GPS Co-ords	
		start	end	start (shore)	end (lake)
Section	**1**	H9500415709	H9493915635	H9496915674	H9497815666
Section	**2**	H9506215666	H9502915590	H9505415627	H9503615625

Section Photos

		Start of Section	Whole Section	End of Section
Section	**1**	3305	3306	3307
Section	**2**	3311	3312	3335

4. Concluding Remarks

This section provides a summary of the results presented in the individual site reports above (Table 371). In addition to the site status, the comments field gives consideration to the key environmental variables affecting site condition and any site-specific issues affecting confidence in assessment outcomes are highlighted. This section concludes by making overall recommendations for future monitoring and assessment priorities for standing waters in Northern Ireland.

Of the 72 standing water sites surveyed, only 3 (Blue Lough, Lough Nafeola and Mallybreen Lough) were assessed as being in favourable condition within the CSM guidelines (JNCC 2015). A further 11 loughs were assessed as being favourable, but fell slightly below the expectations of the CSM guidance, or showed some evidence of possible decline and hence these were classed as being “at risk”

The remaining 58 sites all fell well below the CSM targets for standing waters and were deemed unfavourable. The primary reason for failure was water quality with total phosphorus exceeding the CSM targets in most cases. Where TP was high, there were often clear biological effects manifested within the site.

Although the truncation of the funding allocated to this project means this report falls somewhat short of gaining a comprehensive picture of the standing waters in Northern Ireland, the results are nonetheless of serious concern. The data presented here also appear to show that the decline is on-going with many loughs exhibiting a significant reduction in the abundance of key species and in some cases characteristic species have been lost altogether within the past 25 years. Furthermore, in some cases (see for example Kilroosky Lough) there has even been significant deterioration in condition since sites were surveyed in 2006 (Goldsmith *et al.* 2008).

With eutrophication evidently being one of the primary drivers of this decline, there is an urgent need to determine the primary sources of nutrients within the environment and take action to prevent the current downward trajectory of freshwater sites in Northern Ireland. Diffuse pollution is clearly one area that is difficult to control, but the increasing mechanisation within agriculture is one area that requires further attention. The increasing prevalence of slurry spreading within a region with such high rainfall cannot be ignored. Despite clear guidance, spreading was observed during heavy rain and when the land was clearly waterlogged. In some cases spreading was to within a few meters of watercourses and loughs (e.g. Drumlougher lough). We recommend a regular programme of CSM assessments are implemented, particularly at protected sites) and that additional research is targeted to assess the extent to which diffuse pollution is contributing to the decline in surface water quality in Northern Ireland.
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Table 371 Summary status of the 72 Northern Ireland loughs surveyed 2014 & 2015

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Mulshane Lough	815	H319509	Dystrophic	ENSIS	Favourable, at risk	Encroaching peat cutting may negatively impact the lough if left unchecked. Slightly elevated TP levels and filamentous algal cover present.	A good example of a dystrophic lough in a lowland peat landscape. Raised peat bog with characteristic flora surrounding the lough. Little of this vegetation remains in the surrounding locality (NW of Enniskillen)
Loughnaweelagh	231	H052832	Isoetid	Designated	Favourable, at risk	Close proximity of wind farm and forestry	Site has characteristic water chemistry and 4 characteristic species present: *L. uniflora, L. dortmanna, I .lacustris* and *U. minor*.
Lough Mulken	239	H193763	Isoetid	ENSIS	Unfavourable	Lack of characteristic species for either oligotrophic or mesotrophic lakes. High TP levels.	Few aquatic plants. *P. natans* the only macrophyte present in abundance.
Lough Any	244	H203748	Isoetid	ENSIS	Favourable, at risk.	High TP values	Stable dystrophic lough with 2 characteristic species. High TP levels of concern.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Keenaghan Lough	627	G975598	Isoetid	ENSIS	Unfavourable	Only 1 characteristic oligotrophic spp. and 2 broad-leaved *Potamogeton* spp. at low frequency. Zebra mussels observed in lough.	Water quality is favourable, but flora does not comply with characteristic mesotrophic species. Water brown and turbid – further investigation required.
Lough Achork	630	H042555	Isoetid	Designated	Unfavourable	High TP levels. Only 2 characteristic species present. Appears to be increased sedimentation	Heavy sediment load in parts of the lough. High DOC reducing light penetration into the water column and therefore possibly unlikely to expect Isoetid flora at this site. *P. alpinus* present in good abundance. Palaeoecological work would help to ascertain a site specific baseline for the lough

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Lough Vearty	638	G994658	Isoetid	Designated	Favourable (at risk)	TP is stable, but just above upper limit for oligotrophic loughs. High frequency of *Juncus bulbosus*	Good representation of characteristic species and diverse aquatic macrophyte flora for this lake type. Notable species; *B. ranunculoide*s present in 2006 and 2014.Dominant species similar in 1990, 2006 and 2014. Some concern over high frequency of *J. bulbosus* in marginal areas. Extent and impact of peat cutting and grazing intensity are unknown. Site would benefit from more regular monitoring of water quality and flora.
Meenaghmore Lough	643	G992642	Isoetid	ENSIS	Unfavourable	Decline in *Littorella uniflora.* Accelerated siltation and loss of extent. Low cover of characteristic species Poor land management adjacent to site	Although water quality at the site is relatively good, the concerns over increased sedimentation and decline of *L. uniflora* are unfavourable. Peat cuttings and poor land management along north-eastern shore

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Mallybreen Lough	644	H011661	Isoetid	Designated	Favourable		Water chemistry data are favourable and show successive improvement since 1988. The flora, while not meeting all CSM targets is nonetheless typical of a shallow upland lake with brown water and is considered favourable.
Fir Lough	645	H013649	Isoetid	ENSIS	Unfavourable	Only 1 characteristic oligotrophic sp. No *Littorelletea* spp. TP target exceeded	The site is very shallow and may not therefore be expected to support a full range of characteristic taxa. Site should be monitored for localised nutrient enrichment and low grazing intensity maintained. Site specific species and nutrient targets may help to better assess this lough.
Lough Rushen	646	H019662	Isoetid	ENSIS	Favourable (at risk)	Slightly elevated TP	Mean annual TP concentration within target levels for mesotrophic loughs, but exceed oligotrophic target. Characteristic aquatic flora remains stable since 2006. A reduction in *P. alpinus* and increase in filamentous algae suggest the site would benefit from further monitoring to assess possible impacts of nutrient enrichment.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Lough Scolban	647	G995605	Isoetid		Favourable (at risk)	Mean TP just exceeds the upper limit for mesotrophic waters. Several taxa present in the 2006 survey not recorded in this survey.	Good example of a floristically rich mesotrophic lough. TP is slightly above target levels, suggesting enrichment, but peaty water may affect TP / trophic status relationship. Filamentous algae moderate. Other evidence of enrichment limited. Frequency of *E. canadensis* has decreased since 2006.The site is borderline and it is recommended that it be surveyed again within 3 years to confirm the assessment.
Lough Nafeola	654	H032645	Isoetid	Designated	Favourable		A species rich brown-water site. *N. confervacea* (Nationally Rare), was recorded in 2007 but not in 2014
Lough a Waddy	657	H041644	Isoetid	ENSIS	Favourable, (at risk)	Slightly elevated TP and higher than expected filamentous algae.	Good example of an oligotrophic lough dominated by abundant *Littorelletea* flora, which shows typical zonation.TP is slightly above target levels for an oligotrophic lough, although this may be influenced by the site's organic input and may not be of concern.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Parabaun Lough	664	H059572	Isoetid	ENSIS	Unfavourable	Did not meet the floristic composition targets or coverage. TP concentrations exceeded the upper limit for mesotrophic water bodies.	Diverse and rich marginal species. Notable species: *N. confervacea* and *N. flexilis* present in 2014.Trophic status appears to have improved since 1989, with three additional characteristic species.
Bunnahone Lough	666	H100551	Isoetid	ENSIS	Unfavourable	Above target TP and insufficient number of characteristic species.	Despite failure, a reasonably good example of a mesotrophic lake. Complex interactions of the brown water and high DOC are thought likely to make this lough atypical for its type and hence site specific targets should be sought to better determine overall condition. The lough appears stable and the flora is similar to that recorded in the 1980's (NILS).
Lough Aleater	682	G975495	Isoetid	Designated	Unfavourable	Insufficient number (mesotrophic) and abundance (oligo- and mesotrophic) of characteristic species. Nutrient concentrations higher than target levels.	Relatively species rich site. Further monitoring and palaeoecological work recommended to set more precise targets for nutrients and species

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Lough Anierin	689	G995472	Isoetid	Designated	Unfavourable	Failed to achieve oligotrophic or mesotrophic species frequency target. Water chemistry fails to achieve SCA targets, with unsatisfactory oxygen levels in water column. Blue-green algae observed at time of survey.	Good macrophyte community structure. Grazing and poaching observed around the lough, possible contribution to sediment loading and eutrophication. Further monitoring recommended to assess possible impacts of nutrient enrichment.
Lough Navar	690	H028547	Isoetid	Designated	Favourable, at risk	Fails to meet expected floristic targets.	Does not achieve minimum number of characteristic species for either oligotrophic or mesotrophic lake type. *E. canadensis* frequency has decreased since 1990; water chemistry is favourable and has improved since 1990. Further monitoring recommended to establish presence of characteristic species recorded in 1990 but not 2014.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Derrynacarbit Lough	694	H005506	Isoetid	Designated	Unfavourable	Only 1 characteristic species present at low frequency. Blue green algal bloom at time of survey. TP levels high. Loss of characteristic flora since the NILS survey.	Lake in poor condition, further monitoring recommended.
Lough Doo	697	H038565	Isoetid	Designated	Unfavourable	Low frequency of characteristic species	A reasonable example of an oligotrophic lough, with low nutrient levels and good floristic composition. Low frequency of the characteristic species is however of concern and levels of *J. bulbosus* and *M. alterniflorum* may suggest enrichment, along with high levels of filamentous algae. Further investigation required.
Tullywannia Lough	699	H044508	Isoetid	Designated	Unfavourable	Less that the target number of characteristic species for a mesotrophic lake	*Lagarosiphon major* recorded historically at the site but not in the current survey

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Lough Formal	701	H047474	Isoetid	Designated	Favourable (at risk)	Impact of forestry unknown, but of potential concern during felling and planting	Low frequency of characteristic species for both oligotrophic and mesotrophic status. Floristic compositional targets not met for mesotrophic and *Littorelletea* zones not clear. Water chemistry within feature targets for mesotrophic and appeared to have improved since 1989.
Martincrossagh Lough	709	H058428	Isoetid	ENSIS	Unfavourable	Less that the target number of characteristic species for a mesotrophic lake, high TP amounts and filamentous algal cover	Significant change in the macrophyte community since the NILS survey.
Lough Namanfin	711	H054458	Isoetid	ENSIS	Favourable, at risk	Forest plantations within the catchment, potential risk of felling operations affecting sediment load and water chemistry.	Characteristic macrophyte flora that appears to be stable since the NILS survey.
Lattone Lough	776	H001455	Isoetid	ENSIS	Favourable, at risk	TP levels slightly high	Diverse and characteristic macrophyte flora that appears to be stable since the NILS survey. 3 Isoetid species present and 7 *Potamogeton* species.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Ballydoolagh Lough	812	H285481	Isoetid	ENSIS	Unfavourable	Above target TP, High *E. canadensis* cover and insufficient number of characteristic species.	Despite failure, a reasonably good example of a mesotrophic lake in an agricultural catchment. Disused reservoir dammed at the outflow but with a seemingly natural hydrology. Flora is similar to that recorded in the 1980's (NILS).
Watsons Lough	816	H308496	Isoetid	ENSIS	Unfavourable	Less that the target number of characteristic species for a mesotrophic lake. TP levels above target levels	*N. alba* and *N. peltata* absent from the current survey, present in the NILS survey.
Lough Narye	937	H398338	Isoetid	ENSIS	Unfavourable	Less that the target number of characteristic species for a mesotrophic lake.	Water chemistry favourable and a moderate diversity of macrophyte taxa present.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Mill Lough	966	H466313	Isoetid	ENSIS	Unfavourable	Fails to achieve the floristic requirements for this lake type. Lack of *Littorelletea* species and zonation. Seasonal TP values exceed the upper limit for mesotrophic loughs.	Water chemistry to some extent suggests favourable condition. Further monitoring is recommended to establish whether frequent fishing activities have impacted upon lake trophic status.
Crossbane Lough	1151	H809299	Isoetid	ENSIS	Unfavourable	High TP and TN Low number and cover of characteristic species. Significant reduction in *L. uniflora* *Elodea canadensis* present (established)	Crossbane Lough maintains an interesting marginal wetland flora, but the open water is eutrophic and dominated by non-characteristic species with evidence of species decline.. Site specific floristic targets should be defined and management should focus on identifying and reducing nutrient inputs.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
DrumLougher Lough	1175	H895187	Isoetid	ENSIS	Unfavourable	High TP Decline in abundance of *L. uniflora*. Poor distribution of characteristic species	Drumlougher Lough has extensive areas of species rich wetland which remain the primary ecological interest at the site. The open water is species poor and eutrophic and lacks a characteristic flora. Site specific floristic targets should be defined and management should focus on identifying and reducing nutrient inputs through.
Aughnadarragh Lough	1408	J443594	Isoetid	ENSIS	Unfavourable	High TP High cover of non-native species. Lack of characteristic species	Aughnadarragh Lough has extensive areas of species rich wetland. The open water is eutrophic and dominated by non-characteristic and non-native species. Site specific floristic targets should be defined and management should focus on identifying and reducing nutrient inputs.
Blue Lough	1574	J327253	Isoetid	Designated	Favourable		Upland lough in favourable condition. *Littorelletea* flora present and showing typical zonation pattern, although only low frequency of *L. uniflora*. Water quality favourable, with low TP concentrations and no obvious catchment pressures.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Greenan Lough	1605	J119233	Isoetid	Designated	Unfavourable	High TP High cover of non-native species. Loss of characteristic species Loss of open water habitat	Greenan Lough no longer has any significant characteristic features and has declined since 2006. Eutrophication is likely to be the main cause of decline and management should focus on identifying and reducing nutrient inputs.
Lough Nabrickboy (B)	1635	H036502	Isoetid	ENSIS	Unfavourable	Less that the target number of characteristic species for a mesotrophic lake and TP levels higher than target levels.	A moderate diversity of macrophyte taxa present with 5 characteristic mesotrophic species present.
Innaghachola Lough	1650	H053839	Isoetid	ENSIS	Favourable, at risk	Below guideline cover of characteristic species. Forestry nearby.	Site has characteristic water chemistry and 5 characteristic species present: *L. uniflora, L. dortmanna, I. lacustris, S. angustifolium and U. minor. I. lacustris* recorded at the site for the first time.
Legalough	1667	H088346	Isoetid	ENSIS	Unfavourable	Poor water quality (TP). Low charophyte cover	Site reclassified as H3140. High TP levels and relatively low extent of *Chara* spp.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Burdautien Lough	202	H494283	Marl	Designated	Unfavourable (declining)	Exceeds upper TP limit. Shows significant deterioration since last survey Loss of *Chara* spp.	Site remains clear despite very high TP concentrations. Determining the source of the nutrient pollution and putting a stop to it is a priority for this SAC site. Continuation of high nutrient inputs is likely to see significant and irreversible deterioration of the Lough and loss of an Annex 1 habitat.
Ballaghmore Lough	735	H216438	Marl	ENSIS	Unfavourable	No charophytes present. Limited submerged and floating aquatic flora. High TP concentrations.	Rich and diverse emergent wetland vegetation. Possible enrichment from adjacent agricultural fields – further investigation required.
Castlehume Lough	745	H195505	Marl	ENSIS	Unfavourable	*Chara* present at low frequency (<50% of photic zone). High TP. *E. nuttallii* and zebra mussel present.	*Chara rudis* present in clear zone. Good diversity of aquatic macrophytes. *S. aloides*, *P. lucens* and *P. friesii* present.
Lough Aleen	751	H139545	Marl	ENSIS	Unfavourable	2 *Chara* spp. present at low frequency. High TP.	Lack of diversity and abundance of *Chara* species. Abundance of *P. lucens* is encouraging. *C. mariscus* in the margins

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Carran Lough	753	H139477	Marl	ENSIS	Unfavourable	1 *Chara* spp. present at low frequency. High TP and zebra mussel present.	Lack of diversity and abundance of *Chara* species. Abundance of *P. lucens* and *P. perfoliatus* is encouraging but presence of *P. pectinatus* is also an indication of eutrophication
Lough Yoan	763	H253423	Marl	ENSIS	Unfavourable	Decrease of charophyte abundance since 1988. More than 50% *Elodea canadensis.* TP concentrations exceed CSM target levels.	One species of charophyte (*C. globularis*) present at the site at low frequency. The lough is notable for the presence of *M. verticillatum* and appears to be stable in terms of nutrient status (albeit above CSM target).
Drumacrittin Lough	986	H549328	Marl	Designated	Unfavourable	Very low (decreasing) *Chara* frequency. Nutrient enrichment at site and TP exceeds threshold. Low dissolved oxygen values beneath thermocline.	Investigate nutrient sources. Less intensive agriculture around the lake shore would be beneficial. This site is notable for the presence of Chara rudis.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Annachullion Lough	997	H519303	Marl	Designated	Unfavourable	Loss of 3 Chara species and reduction in abundance of the remaining 2.Increase in M. spicatum to 50% frequency.TP levels exceed CSM guidelines.	A once good example of a *Chara* dominated marl lough, now much degraded. Assessed as favourable in 2006, but now falls well below the CSM criteria for this site type. Further monitoring of the flora and nutrient sources is recommended.
Kilroosky Lough	1005	H495274	Marl	Designated	Unfavourable (declining)	Loss of macrophyte structure. Major downturn in water quality and clarity since 2006.Significant decline in Chara spp. cover. Cyanobacterial blooms present. Poor oxygen levels.	Despite a major decline in the condition of the site, Kilroosky still supports 6 species of stonewort and has excellent marginal vegetation. The priority at the site is to identify the primary sources of nutrients and prevent further enrichment. This was one of the best examples of a marl lough in NI and the decline of this priority habitat is a major concern.
Lough Garrow	1032	H435190	Marl	ENSIS	Unfavourable	Exceeds upper TP limit and has only low *Chara* spp. cover. Zebra mussels present.	Site appears to be relatively stable and would benefit from reduced nutrient inputs.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Tullybrick Lough	1135	H751398	Marl	Designated	Unfavourable	Poor water quality (TP). Low charophyte cover.	Site remains unchanged with high TP levels and relatively low extent of *Chara* spp. cover. The presence of *Chara rudis* makes this site important for its flora and regular monitoring of water quality and the extent of *Chara* beds is recommended.
Doagh Lough	722	H078521	Eutrophic	Designated	Unfavourable	TP just exceeds the upper limit for eutrophic sites. Only 3 characteristic species recorded at relatively low frequency.	Reduced from favourable status in 2006 due to lack of evidence of additional characteristic species. Current mean annual TP concentrations have increased and management should focus on reducing inputs. Permit no fish stocking.
Kinarla Lough	742	H215453	Eutrophic	ENSIS	Unfavourable	High TP and high chl a. Only 4 characteristic species present at low frequency	Continued presence of *P. praelongus* but absence of charophytes. *S. latifolium* present in the lake margins.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Drumcullion Lough	760	H275397	Eutrophic	ENSIS	Unfavourable	High mean annual TP Possible loss of *L. uniflora* since 1990; absence of multiple *Potamogeton* spp. and high abundance of *E. nuttallii* all suggest enrichment. Zebra mussels present. Some poaching of lake shores noted.	Species-rich aquatic macrophyte flora - 5 characteristic species. 42% of wader / boat sample spots record ≥1 characteristic spp.). Abundance of *E. nuttallii* high.
Lough Coole	765	H255434	Eutrophic	ENSIS	Unfavourable	Only 4 characteristic species present and no broad leaved *Potamogeton spp. E. canadensis* abundant and Zebra mussel present.	The site exhibits good water quality and relatively low nutrient levels. The macrophyte community appears stable, but the loss of key characteristic species is of concern.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Killee Lough	810	H295504	Eutrophic	ENSIS	Unfavourable	The lough has only 1 characteristic eutrophic species and has lost 1 characteristic species since 1988.	Marginal and emergent flora is species rich. Limited aquatic macrophyte assemblage but appears to have remained stable since 1988. Moderate frequency of *E. canadensis* may not be detrimental to overall site condition. Nutrient levels appear to have remained stable since 1988.
Round Lough	835	H443485	Eutrophic	Designated	Unfavourable	Only one characteristic species present at low abundance.	Possible characteristic species loss since 1988 – including *Potamogeton crispus.* Excellent trophic status with comparatively low nutrient input, despite being surrounded by improved grassland. Sensitive to nutrient enrichment therefore it is recommended that potential sources of nutrients should be monitored.
Lough Fadda	836	H450485	Eutrophic	ENSIS	Favourable, at risk	High chlorophyll *a* reading in autumn, but macrophyte community appears stable.	The macrophyte community appears stable, characteristic and diverse

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Mill Lough	885	H245385	Eutrophic	Designated	Favourable (at risk)	Risk of *E. canadensis* out-competing aquatic taxa.	13 characteristic species present. Moderate TP levels. *E. canadensis* exceeds FCT targets, but appears to have been stable for over 25 years with no evidence of species loss. 3 new taxa recorded in 2014; *P. pectinatus*, *M. spicatum* and *R. circinatus* are possibly indicative of a shift towards increased eutrophic conditions but currently remain at very low frequency. Stocking of Rainbow trout inconsistent with the conservation status and angling increases the risk of non-native species introductions
Sessiagh	903	H261345	Eutrophic	ENSIS	Unfavourable	Loss of characteristic species P. perfoliatus since the 1980's.High frequency of E. canadensis (49%) and E. nuttallii (19%).Dense mats of Lemna trisulca growing throughout the site, not apparent in 2006.No broad-leaved pondweeds	The lough has a good characteristic aquatic flora, and water quality is within CSM targets. The site does however exhibit signs of deterioration in the flora, particularly the loss of *P. perfoliatus* and recent occurrence of *E. nuttallii.* At risk from zebra mussel invasion. Nutrient inputs should remain low.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Lough Digh	909	H324333	Eutrophic	ENSIS	Unfavourable	TP exceeds upper permissible limit. E. nuttallii is a recent colonist to the site and occurs at high frequency.	Despite high TP and a high frequency of *E. nuttallii,* 5 characteristic species (including a broad-leaved *Potamogeton* species) were present at the lough and had good coverage. Any site management needs to focus on identifying and controlling nutrient sources to prevent any further decline. This includes any further agricultural improvement within the immediate catchment.
Lough Doo	912	H346301	Eutrophic	Designated	Unfavourable	Recent colonisation by *E. nuttallii (*27%)	Moderately species rich and abundant aquatic macrophyte flora - stable since 1988. TP concentration (mean and range) = favourable – most other variables (e.g. Chl *a* / water clarity) suggest favourable water quality.
Drummully Lough	914	H307287	Eutrophic	ENSIS	Unfavourable	Open water hyper-eutrophic, species-poor and dominated by *P. pectinatus* and *Lemna minuta.*	Site considered too shallow to support characteristic aquatic flora. Poor light penetration through water column.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Kilturk Lough	922	H371260	Eutrophic	ENSIS	Unfavourable	Only four characteristic species recorded; High mean annual TP concentration Loss of characteristic species; Possible loss of *L. uniflora* since 1990; Decline of *P. perfoliatus* since 1990.	Species-rich aquatic macrophyte flora - and 79% of wader / boat sample spots record ≥1 characteristic spp. Abundance of *E. canadensis* has decreased. Healthy population of *S. aloides.*
Friars Lough	929	H368271	Eutrophic	ENSIS	Unfavourable	High trophic status and low number of expected characteristic species	Moderately species rich with fairly good coverage of characteristic species across wader and boat transects. Frequency of *E. canadensis* decreased since 1988.
Knockballymore A	949	H476268	Eutrophic	ENSIS	Unfavourable	High trophic status and low number of expected characteristic species	Moderately species rich with fairly good coverage of characteristic species across wader and boat transects. Frequency of *E. canadensis* decreased since 1988.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Knockballymore B	950	H479269	Eutrophic	Designated	Unfavourable	No charophytes present, though recorded as frequent in 1988. TP exceeds CSM target levels.	Site exhibiting symptoms of nutrient enrichment – investigate potential nutrient sources and manage appropriately. TP levels have reduced since 2006.
Back Lough	956	H458307	Eutrophic	ENSIS	Unfavourable	TP exceeds upper permissible limit. Only 2 characteristic species present.	Although lacking in species *richness,* the site maintains a good population of *P. praelongus* and does not appear to suffer from high algal turbidity. Catchment sources of nutrients should be investigated further.
Inver Lough	992	H520312	Eutrophic	ENSIS	Unfavourable	Fails to meet CSM species target Possible decline of broad-leaf *Potamogeton* spp. Borderline water quality	Only 4 characteristic species present in 2014, but flora nonetheless shows good structure. Slurry spreading observed on nearby fields, this should be monitored for any nutrient input to the lough. Permit no fish stocking.
Rose Lough	999	H512298	Eutrophic	ENSIS	Unfavourable	Only 5 characteristic species present in 2014. 46% of sample plots contained one or more characteristic species Nutrient levels exceed CSM targets	The site has remained relatively stable in terms of the flora since 1989, but is hyper-eutrophic. Although the aquatic flora falls below CSM targets, the extensive wetland flora is excellent. Long term nutrient reduction would benefit the lough.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Corraharra	1012	H356228	Eutrophic	ENSIS	Unfavourable	High mean annual TP and TN concentrations. Seasonally high Chl *a.*	5 characteristic species, including 1 broad-leaved *Potamogeton* spp. Excellent marginal / emergent flora. The lough is remarkable in hanging on to its characteristic flora despite being hyper-eutrophic. Efforts should be made to identify and control nutrient inputs to the site.
Castle Lough	1026	H409201	Eutrophic	ENSIS	Favourable (at risk)	TP has increased since 2006.No *P. praelongus* recorded Zebra mussels present, but rare.	Aquatic macrophyte flora is species rich and appears stable since 1988. Moderate frequency of *E. canadensis* may not be detrimental to overall site condition. Nutrient concentrations have remained relatively stable since 1988, although TP appears to be increasing.
Lough Sarah	1027	H423198	Eutrophic	Designated	Unfavourable	*Elodea canadensis* abundance has significantly increased and exceeds target values. Higher than expected filamentous algal abundance. TP levels are borderline favourable.	Aquatic macrophyte flora is species rich and has remained relatively stable since 1989 – appears to be a net decrease in characteristic species and abundance of *P. lucens* may have declined.

Lough Name	Lake No.	Grid Ref	Type	Selection	CSM site condition	Reason(s) for status	Comments
Lurgan Lough Upper	1192	H950157	Eutrophic	ENSIS	Unfavourable	Only 3 characteristic species present in 2015. 53% of vegetated plots contained one or more characteristic species	The site has remained relatively stable in terms of bother flora and water quality. Although the aquatic flora falls below CSM targets, the extensive wetland flora is excellent. A better understanding of the botanical history would allow site specific targets to be defined.

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6. Appendix 1

Table 372 A subset of 251 sites as chosen by NIEA, which have previously been surveyed as part of the Northern Ireland Lake Survey (NILS) of 1988-1991

Lough Name	Lake No.	Grid Ref	Type	Alt (m)	Area (ha)
Lough Fadda	836	H450485	Eutrophic	100	4
Augher Lough	865	H560537	Eutrophic	60	8.75
Fymore Lough	866	H595519	Eutrophic	70	4.5
Sessiagh	903	H261345	Eutrophic	45	8.5
Lough Digh	909	H324333	Eutrophic	55	7
Kilmore Lough	911	H338318	Eutrophic	45	22
Derrymacrow Lough	920	H366252	Eutrophic	45	19
Kilturk Lough	922	H371260	Eutrophic	45	46
Sand Lough	924	H378264	Eutrophic	45	22.75
Inver Lough	992	H520312	Eutrophic	65	12.75
Summerhill Lough	1004	H490280	Eutrophic	55	2.75
Corraharra	1012	H356228	Eutrophic	45	0.5
Pound Lough	1016	H395249	Eutrophic	45	1
Cornabrass Lough	1017	H401245	Eutrophic	45	19
Friary Lough	1067	H748558	Eutrophic	75	5
Roughan Lough	1073	H828688	Eutrophic	60	16
Lough Money	1494	J534456	Eutrophic	30	20
Derrykerrib Lough	1025	H405209	Eutrophic	45	23
Castle Lough	1026	H409201	Eutrophic	45	27.5
Lurgan Lough Upper	1192	H950157	Eutrophic	135	1.5
Kinarla Lough	742	H215453	Eutrophic	45	2.5
Enniskillen (Derrychara)	784	H236437	Eutrophic	45	7.5
Killee Lough	810	H295504	Eutrophic	145	3
Lough Gunnell	857	H495501	Eutrophic	95	1
Corracoash Lough	905	H247340	Eutrophic	55	4
Drummully Lough	914	H307287	Eutrophic	45	8.25
Friars Lough	929	H368271	Eutrophic	45	10
Knockballymore A	949	H476268	Eutrophic	45	2
Rossbrick Lough	954	H458299	Eutrophic	85	1
Cornagague Lough	955	H474304	Eutrophic	85	2
Back Lough	956	H458307	Eutrophic	85	4
Mountsedborough Lough	961	H445308	Eutrophic	85	4
Lough-A-Hache	968	H455313	Eutrophic	85	1
Drumbarrow Lough	991	H528315	Eutrophic	65	1.5
Aghafin Lough	998	H524300	Eutrophic	65	3
Rose Lough	999	H512298	Eutrophic	65	1.5
Brantry Lough	1099	H749539	Eutrophic	105	17.5
Tynanabbey Lake	1108	H758418	Eutrophic	35	3.25

Lough Name	Lake No.	Grid Ref	Type	Alt (m)	Area (ha)
Kiltubbrid Lough (B)	1140	H768393	Eutrophic	55	3
Lough Erne	1248	J323567	Eutrophic	75	20.25
Lough Shark	1275	J065415	Eutrophic	15	27
Aghery Lough	1323	J285536	Eutrophic	115	29.5
Heron Lough	1411	J497582	Eutrophic	30	5
Tullyveery Lough	1423	J498551	Eutrophic	20	1.25
Drumcullion Lough	760	H275397	Eutrophic	45	22
Lough Coole	765	H255434	Eutrophic	50	11
Laragh Lough (B)	881	H223395	Eutrophic	45	2
Lough Corban	906	H310375	Eutrophic	45	6.5
Mill Lough	1009	H337214	Eutrophic	45	21
Upper Lake	1306	J402432	Eutrophic	65	9
Lower Lake Seaforde	1472	J404429	Eutrophic	55	5
Laragh Lough A	880	H226397	Eutrophic	45	13.5
Moor Lough Lake	935	H387298	Eutrophic	60	26.25
Lough Brickland	1288	J111411	Eutrophic	95	14.25
Mcauley'S Lake	1313	J365481	Eutrophic	105	17.75
Ballyroney Lake	1565	J230382	Eutrophic	85	7
Dunalis Reservoir	19	C805305	Isoetid	90	4.00
Lough Doo	27	D174432	Isoetid	155	4.25
Lough Nanskan	45	D110524	Isoetid	90	4.50
Craigmacagan Lough	81	D154497	Isoetid	30	1.50
Ally Lough	83	D151492	Isoetid	30	1.00
Ushet Lough	84	D152485	Isoetid	30	10.00
Killea Reservoir	89	C387163	Isoetid	100	7.00
Lough Ash	120	C483004	Isoetid	155	15.00
Killelagh Lough	142	C834026	Isoetid	120	2.50
Dungonnell Dam	168	D197175	Isoetid	285	27.25
Lough Garve	174	D211177	Isoetid	335	2.50
Loughnacarry	181	D226201	Isoetid	340	0.25
Un-Named	183	D231192	Isoetid	335	0.50
Lough Ascraban	185	D248199	Isoetid	350	1.00
Natullig Lough	189	D250215	Isoetid	370	6.25
Lough Fad	190	D255196	Isoetid	345	3.75
Loughnacally	193	D257211	Isoetid	345	1.50
Lough Galboly	195	D281241	Isoetid	285	3.75
Lough Natrosk	197	D273199	Isoetid	290	3.50
Killylane Reservoir	204	J290984	Isoetid	265	23.00
Moor Lough	228	H447983	Isoetid	180	13.00
Lough Bradan	232	H085816	Isoetid	195	5.00
Lough Mulken	239	H193763	Isoetid	190	1.50
Lough Ayelvin	240	H178755	Isoetid	205	1.00
Loughaboy	242	H194747	Isoetid	180	1.00

Lough Name	Lake No.	Grid Ref	Type	Alt (m)	Area (ha)
Lough Any	244	H203748	Isoetid	185	1.50
Lough Lee	247	H255761	Isoetid	300	15.50
Lough Lack	250	H229735	Isoetid	220	12.25
Loughavigh	251	H244705	Isoetid	200	1.50
Lough Corr	259	H289769	Isoetid	205	3.25
Lough Fea	285	H756870	Isoetid	225	51.25
Loughnapeast	330	H565775	Isoetid	190	4.50
Loughnanallog	339	H599790	Isoetid	190	2.00
Lough Mallon	360	H649749	Isoetid	230	3.75
Evishanoran (B)	371	H664772	Isoetid	215	1.50
Blackrock Reservoir	483	J160911	Isoetid	135	1.50
Ballyvarnet Reservoir	606	J476781	Isoetid	80	1.50
Keenaghan Lough	627	G975598	Isoetid	55	18.00
Glencreawan Lough	628	H025565	Isoetid	245	19.75
Meenameen Lough	629	H029559	Isoetid	230	16.00
Lough Wee	637	G989646	Isoetid	110	2.50
Meenatully Lough	639	G999653	Isoetid	110	4.00
Meenaghmore Lough	643	G992642	Isoetid	110	1.25
Fir Lough	645	H013649	Isoetid	110	1.00
Lough Rushen	646	H019662	Isoetid	115	20.50
Lough A Waddy	657	H041644	Isoetid	140	7.50
Parabaun Lough	664	H059572	Isoetid	285	3.25
Bunnahone Lough	666	H100551	Isoetid	75	25.00
Lough Bresk	669	H201601	Isoetid	65	23.00
Raw Lough	672	H251618	Isoetid	150	1.25
Carricknagower Lough	692	H003542	Isoetid	225	4.00
Meenagleragh Lough	696	H030505	Isoetid	180	7.50
Lough Ora	708	H066427	Isoetid	215	7.25
Martincrossagh Lough	709	H058428	Isoetid	215	1.00
Lough Namanfin	711	H054458	Isoetid	260	4.00
Dooletter Lough	718	H100430	Isoetid	160	1.00
Lough Fadd	723	H077529	Isoetid	135	5.00
Monawilkin Lough	724	H082529	Isoetid	140	6.00
Coolyermer Lough	732	H181424	Isoetid	55	13.50
Lattone Lough	776	H001455	Isoetid	75	30.00
Ballydoolagh Lough	812	H285481	Isoetid	135	17.25
Watsons Lough	816	H308496	Isoetid	165	3.50
Derrin Lough	817	H333485	Isoetid	170	3.00
Topped Mountain Lough	818	H309452	Isoetid	200	4.50
Lough Skale	819	H309441	Isoetid	200	4.00
Lough Eyes	820	H325435	Isoetid	80	22.00
Clabby Lough	827	H414494	Isoetid	120	0.20
Lough Natroey	845	H500403	Isoetid	255	9.00

Lough Name	Lake No.	Grid Ref	Type	Alt (m)	Area (ha)
Cloghcor Lough	855	H530487	Isoetid	140	1.25
Derrycloony Lough	867	H585508	Isoetid	90	1.50
Carrickavoy Lough	869	H582494	Isoetid	165	1.50
Lough-Na-Heery	874	H563445	Isoetid	300	4.50
Lough Narye	937	H398338	Isoetid	140	7.50
Lough Lea	941	H403363	Isoetid	165	6.00
Mill Lough	966	H466313	Isoetid	85	18.25
Corranny Lough	972	H478332	Isoetid	115	2.75
Corry Lough	976	H465364	Isoetid	225	6.00
Lough Asladee	980	H491391	Isoetid	250	4.00
Lough Tawy	982	H491390	Isoetid	260	3.50
Mullycar Lough	1069	H744569	Isoetid	85	2.75
Eskragh Lough	1082	H772618	Isoetid	95	15.75
Derrylard Quarry	1089	H958615	Isoetid	20	1.00
Straghans Lough	1147	H823307	Isoetid	155	7.00
Crossbane Lough	1151	H809299	Isoetid	180	1.75
Clay Lake	1157	H835325	Isoetid	185	38.25
Aughnagurgan Lough	1159	H874311	Isoetid	205	4.75
Gentle Owen'S Lake	1160	H839300	Isoetid	195	8.50
Tullynawood Lake	1161	H860295	Isoetid	210	27.00
Sheetrim Lough	1174	H907194	Isoetid	105	2.00
Drumlougher Lough	1175	H895187	Isoetid	115	2.50
Lough Ross	1178	H885155	Isoetid	85	90.25
Lough Patrick	1182	H884193	Isoetid	95	24.00
Lough Alina	1184	H884183	Isoetid	95	7.00
Drumboy Lough	1185	H907113	Isoetid	75	3.00
Cappagh Lough	1188	H910129	Isoetid	105	2.00
Glassdrumman Lough	1194	H965148	Isoetid	95	3.00
Cashel Lough Upper	1203	H968196	Isoetid	140	5.50
Cashel Lough Lower	1204	H969204	Isoetid	135	2.00
Begnylake	1326	J306497	Isoetid	90	14.00
Carrickmannan Lough	1406	J442602	Isoetid	65	6.00
Aughnadarragh Lough	1408	J443594	Isoetid	65	2.25
Blue Lough	1571	J306275	Isoetid	455	0.50
Altnadualake	1579	J313349	Isoetid	100	2.50
Un-Named	1595	J006169	Isoetid	120	1.00
Binnian Lough	1612	J325242	Isoetid	455	1.50
Lough Nabrickboy(B)	1635	H036502	Isoetid	205	1.25
Innaghachola Lough	1650	H053839	Isoetid	340	1.50
Tullynasiddagh Lough	1666	G984652	Isoetid	110	49.75
Lega Lough	1667	H088346	Isoetid	170	2.00
Ballaghmore Lough	735	H216438	Marl	45	3
Rossole Lough	736	H225434	Marl	45	14

Lough Name	Lake No.	Grid Ref	Type	Alt (m)	Area (ha)
Drumcose Lough	744	H185507	Marl	45	3
Castlehume Lough	745	H195505	Marl	45	51
Fardrum Lough	748	H181501	Marl	80	2
Lough Aleen	751	H139545	Marl	45	6
Carran Lough	753	H139477	Marl	55	25
Lough Yoan	763	H253423	Marl	45	13
Breandrum Lough	766	H249431	Marl	45	1.25
Cooy Lough	774	H234483	Marl	45	12
Un-Named	887	H261392	Marl	45	3.5
Dummys Lough	948	H488275	Marl	55	3.75
Rathkeevan Lough	996	H539303	Marl	65	1.5
Lough Garrow	1032	H435190	Marl	45	5
Un-Named(Caledon Estate)	1104	H757447	Marl	35	2.25
Kiltubbrid Lough A	1139	H769397	Marl	55	1.5
Ballydugan Lough	1468	J458426	Marl	10	12
Lough Analbanagh	849	H540441	Dystrophic	345	5.5
Lough Sallagh	848	H531438	Dystrophic	365	1
Lough Nacree	335	H566787	Dystrophic	195	1.75
Glenariffa	182	D225196	Dystrophic	350	1.5
The Fly Lough	286	H761858	Dystrophic	230	2
Lough Anillan	322	H575795	Dystrophic	180	2
Lough Ouske	276	H707934	Dystrophic	320	2
Lough Nadarragh	331	H567778	Dystrophic	190	2
Lough Nacrackin	334	H568786	Dystrophic	195	1.75
Lough Carn	336	H575789	Dystrophic	185	7.75
Lough Napeast	1654	H575794	Dystrophic	180	2
Craigfada	179	D263168	Dystrophic	340	1
Lough Nafanoghy	164	D194200	Dystrophic	280	1.5
Lough Hamul	707	H067414	Dystrophic	195	3
Lough Natroy	853	H505462	Dystrophic	275	1.25
Lough Mulderg	715	H100451	Dystrophic	325	2
Mulshane Lough	815	H319509	Dystrophic	175	1.5
Mill Lough	283	H742886	Dystrophic	230	1.25
Eskinatowey Lough	233	H070804	Dystrophic	260	1
Unnamed (Kilbroney)	1610	J215216	Dystrophic	345	1
Lough Nabrackey	316	H572796	Dystrophic	185	1
Lough Acrottan	720	H064469	Dystrophic	330	1.5
Carnmore Lough	975	H471359	Dystrophic	285	2
Lough Naroon	138	D006171	Dystrophic	205	1.5
Lough Anlaban	663	H054563	Dystrophic	295	1.5
Lough Patrick	280	H749904	Dystrophic	250	2
Lough Doo	254	H231715	Dystrophic	205	1

Lough Name	Lake No.	Grid Ref	Type	Alt (m)	Area (ha)
Lough Nagor	731	H144418	Dystrophic	365	1
Lough Nakinroey	229	H092834	Dystrophic	190	1
New Lough	309	H499842	Dystrophic	165	1.25