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Fresh-water macrophyte survey
of Loch Maree, West Ross
1988

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CONTENTS

1.	Introduction	1
1.1	Background to survey	1
1.2	Previous survey work	1
1.3	Geology and morphology	2
2.	Methods	3
3.	Results	7
3.1	Vegetation	7
3.1.1	Loch Maree	7
3.1.2	Lochans on Eilean Subhainn	9
3.2	Classification	10
3.2.1	Loch Maree	10
3.2.2	Lochans on Eilean Subhainn	10
3.3	Water Chemistry and Clarity	12
4.	Discussion	15
4.1	Classification	15
4.1.1	Loch Maree	15
4.1.2	Lochans on Eilean Subhainn	15
4.2	Vegetation distribution	15
4.3	Comparison of Loch Maree with other 'large' lochs in NW Region	17
5.	Summary	23
6.	Acknowledgements	24
7.	References	25
Appendices		
I	Detailed descriptions of each section	26
II	Species lists and maps for each section	29
III	Plant species recorded for Loch Maree and lochans on Eilean Subhainn	54
Annex - in selected copies only		56

Maps

Map 1	Location of survey sections.	4
Map 2	Location of water sample collection points.	6

Tables

Table 1	Nationally scarce plant species found at Loch Maree.	8
Table 2	Nationally scarce plant species found in lochans on Eilean Subhainn.	8
Table 3	A comparison between Loch Maree and associated lochans with the national sample of loch types 2 and 3.	11
Table 4	pH and conductivity.	14
Table 5	Chemical analysis (Loch Maree).	14
Table 6	Comparison of surveyed lochs larger than 200 ha occurring in NW Region.	18
Table 7	Comparison of conservation features for surveyed lochs larger than 200 ha in NW Region.	19
Table 8	Sites larger than 1,000 ha in NW Region.	21
Table 9	Comparison of features for Lochs Morar, Shiel, Ness and Maree.	21

Appendix Maps

40

1. Introduction

Loch Maree (28.75 square km) is the largest sheet of freshwater in mainland Britain north of Loch Ness, and is the fourth largest freshwater loch in Scotland (Murray and Pullar 1910). Murray and Pullar's survey (which covered 562 sites in Scotland, including all the largest sites) ranks the loch eighth by length (21.66 km), eleventh by maximum depth (111.86 m), fourteenth by mean depth (38.19 m) and sixth by volume (1091.4 million cubic metres). This report details the findings of a macrophyte survey carried out between 8 - 12 August 1988.

1.1 Background to survey

Loch Maree is one of several large lochs within the NW (Scotland) Region of the Nature Conservancy Council (NCC). All these lochs are susceptible to the effects of changing land use (eg large scale afforestation within the catchment), a change in use of the loch (eg the introduction of hydro-electric schemes), pollution (eg acid rain) or amenity use (eg a change from low intensity fishing to commercial fish farming). Several of these other lochs have previously been covered as part of an on-going survey of freshwater lochs within Scotland (eg Lochs Ness and Affric in Inverness, Lochs Naver, Hope, Brora, and Assynt in Sutherland and Lochs Calder and Watten in Caithness). Loch Maree was surveyed at the request of the Regional Office (NW Scotland), to provide information of a similar quality and content to that already collected from other large sites so that comparisons between sites could be made.

In addition to the main survey, the four small lochans on Eilean Subhainn were also visited.

1.2 Previous survey work

Murray and Pullar (1910), collected depth and temperature recordings, and incidental information about the vegetation, but no species list was published. The south east shore of the loch forms part of Beinn Eighe National Nature Reserve (NNR). The woodland here and on the islands is mentioned in

the Nature Conservation Review (NCR) (Ratcliffe 1977). Several surveys have been conducted by NCC in this area. However, no comprehensive survey of the aquatic vegetation of the loch has ever previously been carried out, nor has the aquatic invertebrate fauna been systematically sampled.

1.3 Geology and Morphology

Several detailed descriptions of the geology and formation of Loch Maree and the surrounding area are available in the literature (eg Harker 1941, Pheister 1960 and Peach and Horne 1910), and only a very brief summary is given here.

The geology of the Loch Maree catchment can be divided into 2 broad groups; Lewisian Gneiss along the north east and south west of the loch and Torridonian Sandstone along the extreme north east, the south west shore and the islands. Small areas of Cambrian and early Ordovician rocks are also found at the south east of the loch. Peach and Horne (1910) classified lochs according to their structure and origin. They suggest that Loch Maree is a valley rock basin formed by ice action. Survey work by Murray and Pullar (1910), revealed that the loch consists of three basins, one, the Ghruiddh basin, is U-shaped and extends from the east end of the loch to Eilean Subhainn. At one time the loch would have extended up the valley towards Kinlochewe, but siltation by the inflow streams has occurred. The second basin is the Slattadale basin around and to the south of the islands. The Ardlair basin lies beyond the islands to the north. One of the islands, Eilean Subhainn contains four lochans, one of which is a rock basin approximately 21m deep (Murray and Pullar 1910).

The method used for the survey was based upon the standard technique employed by the loch survey team in their surveys of Speyside, Orkney, Caithness, Sutherland, Inverness and Deeside (eg Charter 1988, Bell 1989), with modifications for the large size of Loch Maree and problems of access.

The loch was divided into 11 sections (Map 1). Some were surveyed by walking the shore, and in some cases a double rake head grapnel was used to sample plants from the deeper water. Other sections (including the water around the islands) were surveyed from a boat. Due to the clarity of the water many observations of plants could be made directly from the boat. Where the water was more turbid, transects were made, trailing the grab behind the boat and raising it at frequent intervals to record the plants. Most of the loch shore was surveyed by one method or the other, but a section of the north west shore was not visited because permission was withheld by the owner for a survey of this section by boat. (This area of steep bedrock shores makes surveying by boat a necessity.) The four small lochans on Eilean Subhainn were also only surveyed from the edge. The macrophyte species present in each section were recorded together with an estimation of their abundance using the DAFOR scale where:

D = Dominant
A = Abundant
F = Frequent
O = Occasional
R = Rare

The prefix L Locally was also used to qualify the distribution of some species eg LF Locally Frequent.

In addition, the main plant communities were mapped on a 1:10,000 outline map, together with the location of any rare species. For the purpose of this report, rare species are those which occur in between 15 to 100 10 km squares nationally or are considered to be in need of special protection in the Highland River Purification Board area (HRPB) (Palmer and Newbold 1983).

In this report vegetation is classified into two broad groups depending on growth form. These are:

- (i) open water or submerged and floating species (which are usually rooted in water although their flowering parts are above the water surface eg Lobelia dortmanna, or they may be free floating eg Utricularia spp.), and
- (ii) edge or marginal and emergent species (which are species which may be rooted in wet areas or may be tolerant of periodic flooding eg Carex spp and Potentilla palustris).

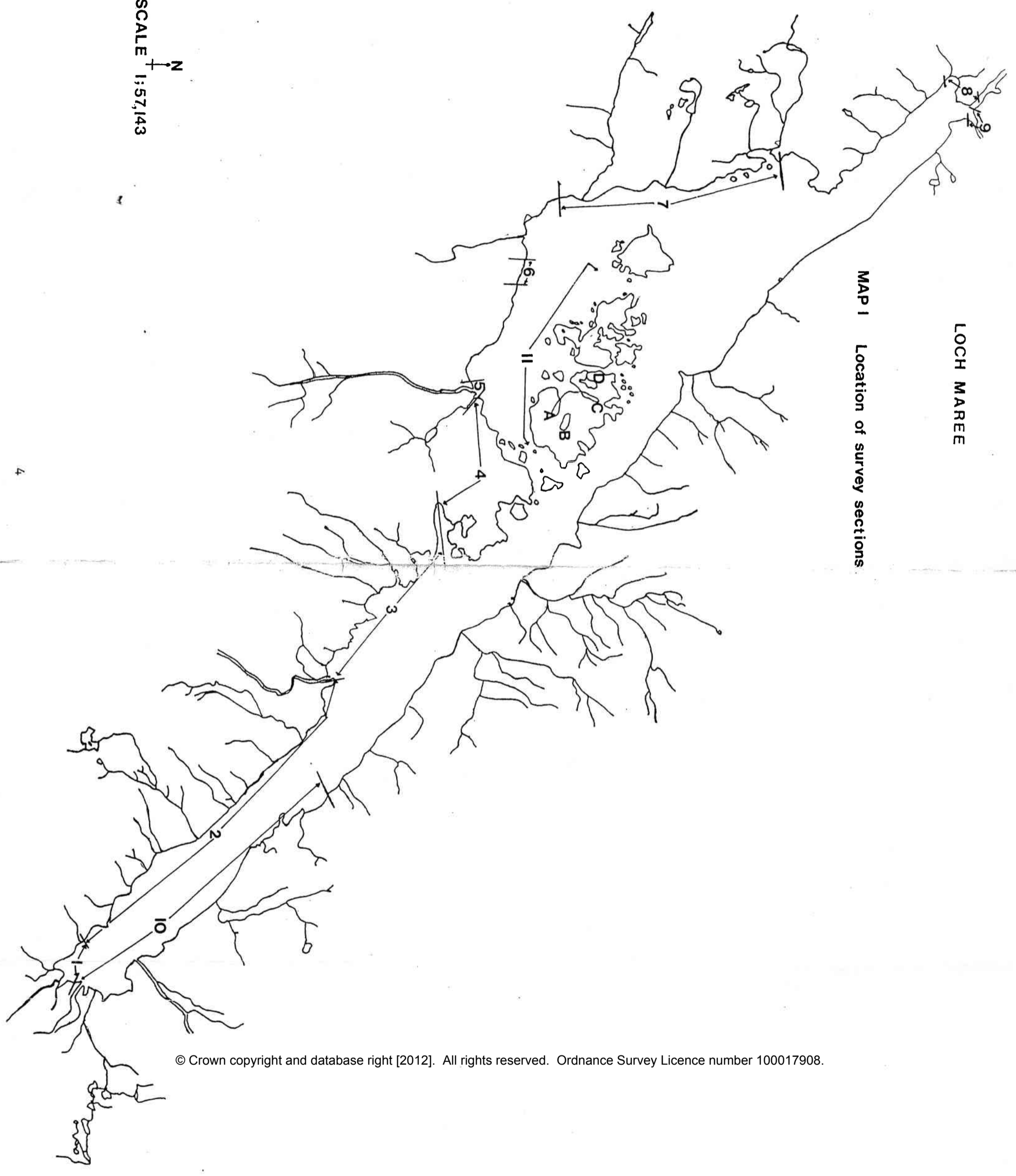
Lochs can be classified into groups containing similar communities of open water species (Palmer 1989). Also lochs can be classified according to the edge vegetation communities which are present on the shore (Rodwell in. prep.). Loch Maree and the lochans on Eilean Subhainn are classified in this report by their open water and edge vegetation.

Records of substrate were made within each section and some water chemistry data were also collected. Samples were taken on four days from different points of the loch and were tested for pH and conductivity the same day. A sample was also collected from the outflow and analysed by the HRPB for major ions and nutrients. pH and conductivity was determined for two of the lochans on Eilean Subhainn. The location of all water chemistry sites is marked on Map 2.

A secchi disc reading was made to give an estimation of water clarity. The reading was made when the second water sample was collected (see Map 2).

LOCH MAREE

MAP 1 Location of survey sections



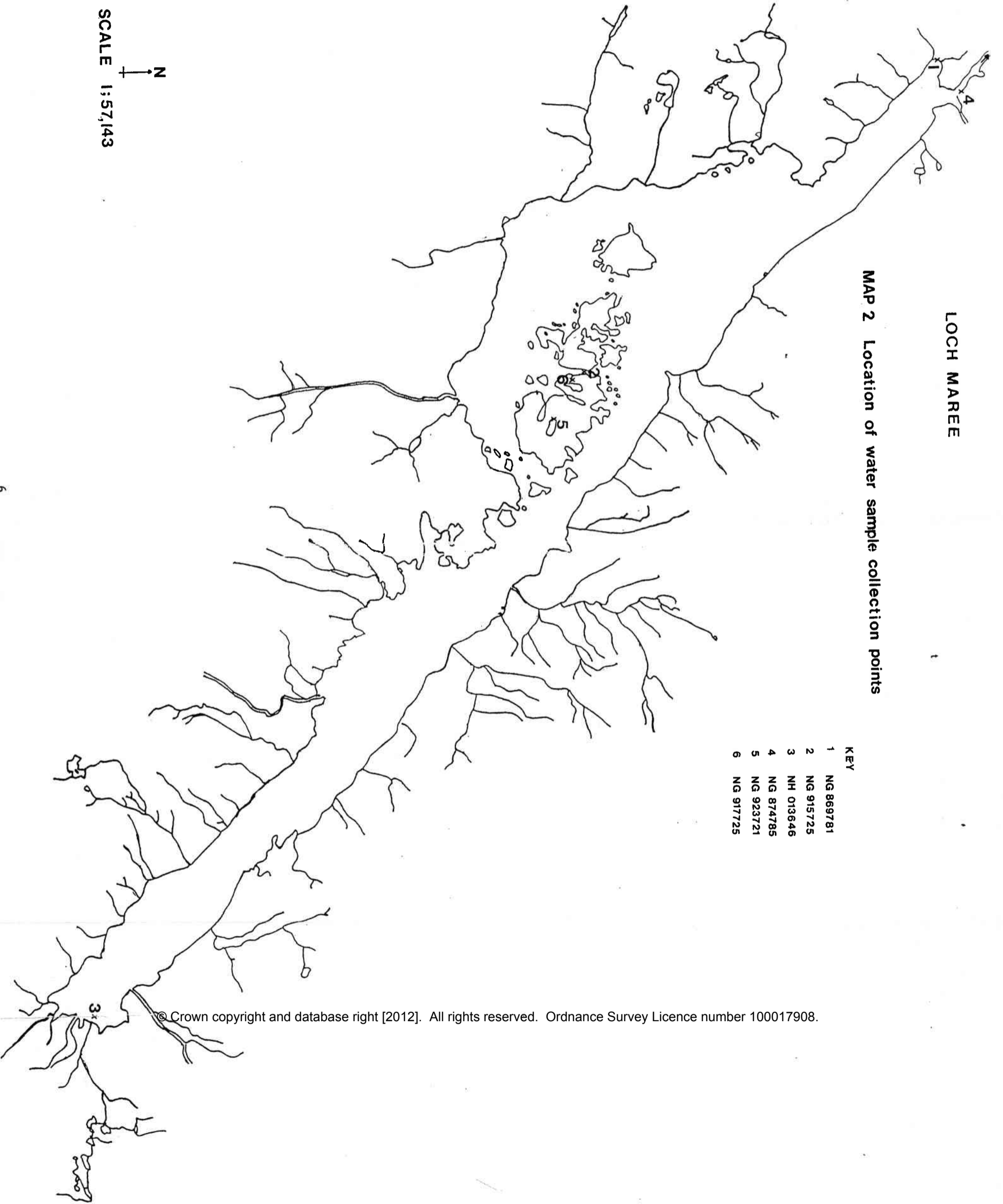
SCALE 1:57,143

LOCH MAREE

MAP 2 Location of water sample collection points

KEY

1	NG 869781
2	NG 915725
3	NH 013646
4	NG 874785
5	NG 923721
6	NG 917725



3. Results

3.1 Vegetation

A summary of the main features of the vegetation is given here. Detailed descriptions of each section surveyed can be found in Appendix I.

3.1.1 Loch Maree

Species

34 species were recorded during the survey, of which 20 were edge species and 16 open water (ie two species were found both as edge and open water species). For a list of the species found see Appendix 2. Several species which are nationally scarce or which require special protection in the Highland River Purification Board (HRPB) area were found (Palmer and Newbold 1983). These are listed in Table 1.

Communities

The vegetation can be summarised as follows:

Edge vegetation is limited to small amounts of Eleocharis multicaulis and Equisetum fluviatile in sheltered areas of the southern shore. Little vegetation was found on the north shore. Littorella uniflora was the main open water species found around the islands, together with Lobelia dortmanna. Myriophyllum alterniflorum occurred frequently at the eastern end, with Nitella flexilis var flexilis present in deeper water. Juncus bulbosus var fluitans was also present in shallower areas. Isoetes lacustris¹ was found in deeper water, usually

¹ Some specimens of Isoetes have been sent to the British Museum for chromosome counts. Some of the plants found are an unusual form which may be a hybrid between I. lacustris and I. echinospora. A final decision has not yet been made. (A.C.Jermy, pers. comm.)

Table 1. Nationally scarce plant species found at Loch Maree

Species	No 10 km squares
<i>Deschampsia setacea</i>	36
<i>Lycopodiella inundata</i>	53
<i>Subularia aquatica</i>	84

Table 2. Nationally scarce plant species found in lochans on Eilean Subhainn

Species	No 10 km squares
<i>Deschampsia setacea</i>	36
<i>Elatine hexandra</i>	39
<i>Isoetes echinospora</i>	59
<i>Lycopodiella inundata</i>	53

around the islands. The small, sheltered shallow bays which occur on the south shore were well vegetated with Littorella uniflora, Lobelia dortmanna, Potamogeton natans and Sparganium spp.

3.1.2 Lochans on Eilean Subhainn

Vegetation and communities

32 species were recorded from the lochans, of which 15 were edge species and 18 were open water species. Reasons for the greater variety of open water species present are suggested in the Discussion section (4.2). Several species which are nationally scarce, or which require protection in the HRPB area (Palmer and Newbold 1983) were recorded. These are listed in Table 2.

Lochan A (see Map p50) contained 10 edge species and 14 open water species (one of these occurred as both an edge and an open water species). Littorella uniflora and Lobelia dortmanna were found, as in Loch Maree, in addition to dense growths of Scirpus fluitans. Nymphaea alba was also recorded. Elatine hexandra and Deschampsia setacea were found in the channel linking this lochan with Loch Maree.

For Lochan B (see Map L p51), only five edge species and seven open water species were recorded. No nationally or locally scarce species were recorded from this lochan.

Lochan C (see Map M p52), was similar to lochan A. It contained seven edge species and ten open water species including the nationally scarce Isoetes echinospora and Lycopodiella inundata.

Lochan D (see Map N p53), was dominated by Carex rostrata and there was little open water. Only four edge and four open water species were recorded.

3.2 Classification

Palmer (1989) identified ten different 'types' of loch based on TWINSPAN (Two way indicator species analyses) analyses of the aquatic vegetation of over 1000 standing freshwater bodies throughout Great Britain. These loch types cover all possible trophic states of a loch from oligotrophic to eutrophic.

Large stands of emergent vegetation can also be classified according to the dominant species as part of the National Vegetation Classification (NVC); Swamp and tall herb fen vegetation (Rodwell in. prep.).

3.2.1 Loch Maree

Loch Maree is a type 3 loch in Margaret Palmer's system. The plant species most commonly found in such sites (ie those species occurring in more than 60% of the TWINSPAN sample) are Myriophyllum alterniflorum, Juncus bulbosus var. fluitans, and Littorella uniflora. A mean of 9 open water species and 17 total species was found within the national sample. A comparison of the features for the national sample with those obtained at Loch Maree and the lochans found on Eilean Subhainn is given in Table 3.

Loch Maree did not contain sufficient emergent vegetation to be classified into NVC communities.

3.2.2 Lochans on Eilean Subhainn

Lochans A and B can also be classified as loch type 3 even though their species composition is not identical (eg Scirpus fluitans present in Lochan A but not in Lochan B) nor identical to that for Loch Maree, (eg Nitella flexilis var flexilis found in Loch Maree but not in the lochans). They all contain the characteristic species of this type. Lochans C and D can be classified as loch type 2 (although

Table 3. A comparison between L. Maree and associated lochans with the national sample of loch types 2 and 3 based on table taken from Palmer 1989

Site & Loch type	Usual pH	Usual conductivity (umhos)	Trophic state	Substrate	Geology/ soil	Mean No	Mean No
						open water species	Total species
National type 2	5-7.5 (mostly <7)	10-200	Oligotrophic	Fine to coarse; often peat	Base-poor rocks (e.g. gneiss, granite)	7	14
National type 3	5-7.5 (mostly <7)	10-200	Oligotrophic	Predominantly coarse (stones, boulders) but some peat	Base-poor rocks (e.g. gneiss, granite)	9	17
Loch Maree Type 3	6.28-6.59	39-43	Oligotrophic	Mainly stones, boulders, bedrock	Lewisian Gneiss, Torridonian sandstone	16	35
Lochan A Type 3	-	-	Oligotrophic	Mixed fine and coarse	Torridonian sandstone	14	23
Lochan B Type 3	4.97	54	Oligotrophic	Mixed fine and coarse	Torridonian sandstone	7	12

Table 3 continued

Site & Loch type	Usual pH	Usual conductivity (umhos)	Trophic state	Substrate	Geology/soil	Mean No open water species	Mean No Total species
Lochan C Type 2	-	-	Oligotrophic	Mixed fine and coarse	Torridonian sandstone	10	17
Lochan D Type 2	5.25	62	Oligotrophic	Mainly silt sandstone	Torridonian	4	8

Lochan C contains some species more typical of loch type 3 eg Isoetes lacustris). The main features of Type 2 lochs are summarised in Table 3.

Such sites are less species rich than type 3 lochs; mean of 7 open water and 14 total species recorded for the national sample. The most characteristic species (ie those occurring in more than 60% of the national sample) are Potamogeton polygonifolius, Lobelia dortmanna, Juncus bulbosus var. fluitans, Littorella uniflora and Potamogeton natans.

Lochans C and D had stands of emergent vegetation which could be classified using the NVC Swamp and Tall Herb Fen section. In both cases the vegetation was classified as S9/2, Caricetum rostratae, Menyanthes trifoliata sub-community.

3.3 Water chemistry and clarity

Table 4 shows the pH and conductivity values recorded from four different points of Loch Maree on four different dates. For locations of samples refer to Map 2. pH and conductivity values for two of the lochans on Eilean Subhainn are also given. An analysis of the major ions and nutrients (Loch Maree only) is presented in Table 5. A secchi disc reading was taken to give an estimation of clarity. The location of this is also marked on Map 2. The disc was still visible at a depth of 4.6m when it reached the loch floor.

Table 4. pH and conductivity

Location	Date collected	pH	Conductivity us/cm
1. Tollie Bay			
NG869781	08.08.1988	6.28	47.0
2. NG915725	09.08.1988	6.34	43.0
3. NHO13646	10.08.1988	6.59	39.0
4. Inveran			
NG874785	12.08.1988	6.57	41.0
5. Lochan B			
NG923721	11.08.1988	4.97	54.0
6. Lochan D			
NG917725	11.08.1988	5.25	62.0

Table 5. Chemical analysis (Loch Maree) (From point 4, see Table 3)

Parameter	Value (mg/L)
Ammoniacal Nitrogen (as N)	0.009
Nitrite (as N)	0.003
Chloride (as Cl)	10.8
Total Alkalinity (as CaCO ₃)	7.0 <i>0.140 meq l⁻¹</i>
Ortho Phosphate (as P)	0.029 <i>??</i>
Silicate (as SiO ₂)	1.181
Calcium (as Ca)	2.79
Magnesium (as Mg)	1.2
Aluminium (as Al)	0.072
Potassium (as K)	0.3
PO ₄ -P (total)	<u>0.0302</u> <i>??</i>

4. Discussion

4.1 Classification

4.1.1 Loch Maree

A comparison of the main features recorded at Loch Maree with those found for the national sample shows it to be a typical example of a Type 3 loch (see Table 3). Such lochs are described as oligotrophic and usually occur on base-poor rocks such as granite or moine schists. Type 3 lochs show a northern distribution in Britain, and there are many in NW (Scotland) NCC Region.

4.1.2 Lochans on Eilean Subhainn

Two sites were also classified as type 3 lochs, the other two were classified as type 2 lochs.

Type 2 lochs are also oligotrophic, but they are often influenced by peat to a greater extent than type 3 sites. The substrates also differ (see Table 3).

4.2 Vegetation distribution

Water chemistry plays an important part in determining which species will be present in a loch. However, other factors affect the distribution of species within a site such as exposure, turbulence, substrate, water clarity (and hence light penetration) and competition. Spence (1967) has studied the factors controlling the distribution of species between lochs and within specific lochs. Some factors which may control the distribution of vegetation within Loch Maree, are now suggested with reference to this work of Spence (1967).

The main factors affecting the distribution of species within Loch Maree are the shape of the loch and prevailing wind direction. For much of its length, Loch Maree consists

of long exposed shores liable to wind action. Submerged plants find it difficult to withstand battering by waves as these can tear the leaves and uproot the plants. The main species found along the southern shore (where there is greatest wave action) is Littorella uniflora, a rosette plant. This growth form is the least vulnerable to damage by wave action. In addition this plant propagates by runners which will aid in pinning it to the loch floor by the production of dense beds of vegetation.

Subularia aquatica which also has this growth form, (although it does not produce runners), was found along this shore. Lobelia dortmanna also has a rosette growth form, but it produces an aerial flowering spike which is vulnerable to wave action. The greatest concentration of Lobelia plants was found around the islands where wave action would be reduced.

Much of the north shore of the loch consists of sheer bedrock which it is difficult for aquatic plants to colonise.

Floating leaved species are especially vulnerable to damage of the leaf area (and hence photosynthetic ability) by wave action. Few floating leaved species were found in the site, and those which were present were found in small sheltered bays on the southern shore where wave action would be reduced. Nymphaea alba was found in two of the lochans on Eilean Subhainn. These sites are small, so large waves are unlikely, and they are further sheltered by the woodland on the islands.

Isoetes lacustris and Nitella sp. are able to utilise low light levels. These species were found in the deeper water.

Myriophyllum alterniflorum is usually found associated with a flow of water. Its main distribution is around the eastern end of the loch where there are several inflow streams bringing in nutrients.

4.3 Comparisons of Loch Maree with other 'large' lochs in NW Region

Several large lochs (having an area of 200 ha or more) occur within NW (Scotland) region². 18 of these sites have been surveyed, of which 17 can be classified as loch type 3 sites. Loch Watten (in Caithness), is a type 7 loch. A brief discussion of some conservation features for the type 3 sites which have been surveyed is given below. To produce a form of objective comparison the lochs have been ranked in descending order for

- (i) the number of open water species,
- (ii) total number of species,
- (iii) presence of rare³ species at a site, and
- (iv) a final rank derived from the sum of the three previous ranks.

These ranks are presented in Table 6.

Several Sutherland sites have more species recorded than Loch Maree although L. Maree scores relatively highly for the number of species present (ranked 6 for number of open water species, 7 for total number of species present). These species totals exceed the national mean values for a loch of this type (Palmer 1989). The site also scores highly for the presence of rare species. In addition to the nationally scarce species recorded in the loch itself others were found in the lochans on Eilean Subhainn, or in the connecting channels between these lochans and L. Maree (see section 3.1.2). Table 7 lists other conservation features for these sites. It is difficult to produce an objective assessment for many of these features. Plus and minus signs indicate particularly good or bad features respectively for some sites.

² Sutherland, Caithness, Inverness, Skye and Lochalsh, Lochaber and Ross & Gromarty

³ Rare species are taken here to include those species generally considered nationally scarce (ie occurring in between 15 - 100 10 km squares nationally (Ratcliffe 1989)), or which are in need of special protection within the HRPB area (Newbold and Palmer 1983). Three points have been allocated for every nationally scarce species present at a site and two for every species in need of special protection within the HRPB area.

Table 6. Comparison of surveyed lochs larger than 200 ha occurring in NW Region

Site	Area of search	Area ha	Number of open water species	Rank	Total No of species	Rank	Rare * ¹ species points	Rank	Overall* ² rank	Existing Status
Brora	SES	226	21	2.5	43	1	13	1	1	
Cam	NWS	236	21	2.5	42	2.5	6	3.5	2	Part SSSI
Naver	NWS	563	22	1	37	4.5	3	8.5	3	Part SSSI
Stack	NWS	230	20	4	42	2.5	3	8.5	4.5	SSSI/NCR
Maree	WR	2875	16	6	34	7	9	2	4.5	Part SSSI
Meadie	NWS	216	15	7.5	35	6	0	15.5	10	
Loyal	NWS	653	18	5	37	4.5	2	12.5	6	
Assynt	NWS	750	15	7.5	29	9	3	8.5	7	
Calder	C	384	11	14	29	9	5	5	8.5	
Hope	NWS	640	13	9.5	26	12	3	8.5	11	
Choire	NWS	296	12	11.5	23	13	3	8.5	12	
Affric	I	200	13	9.5	21	15	6	3.5	8.5	SSSI
More	NWS	350	11	14	22	14	3	8.5	14	
Ness	I	8409	11	14	29	9	2	12.5	13	
Rimsdale	SES	330	12	11.5	27	11	0	15.5	15	
Badanloch/ nan Clar	SES	613	10	16	19	16	0	15.5	16	
Duntelchaig	I	500	5	17	16	17	0	15.5	17	

Area of Search Codes: SES South East Sutherland
 NWS North West Sutherland
 WR West Ross
 C Caithness
 I Inverness

*'Rare' refers to species which are nationally scarce (ie occur in less than 100 km squares nationally) or are in need of special protection within the HRPB area (Palmer & Newbold 1983). Three points have been awarded for every nationally scarce species present and two for every species in need of special protection within the HRPB area.

*Overall rank for number and rarity of species present. Area is not included.

Table 7. Comparison of conservation features for surveyed lochs larger than 200 ha in NW Region

Site	Area of search	No. of substrate types	No. of NVC communities	*1 No. of communities	No. of Reedswang stands	*2	Presence of wet-land edge	Man-made Y/N	Damages	*3	Number of Potamogeton species	Semi-Natural Catchment
Brora	SES	7	4	4	2+	X	N	1,2,3,4	5+			
Cam	NWS	6	1	1	0	X	N	3,6	8+			
Naver	NWS	7	3	3	1+	/+	N	2,5,6,7	6+			
Stack	NWS	6	1	1	1+	/+	N	8,7	3			
Maree	WR	6	0-	0-	0	X	N	3,8	2			
Meadie	NWS	8	2	2	0	X	N	2,3	4			+
Loyal	NWS	8	1	1	0	X	N	2,3,6,9	3			
Assynt	NWS	5	0-	0-	0	X	N	2,3,8	5+			+
Calder	C	9	3	3	0	/+	N	2,4,6,0	4			
Hope	NWS	5	1	1	1+	X	N	2,3	2			
Choire	NWS	6	0-	0-	0	X	N	2,3,6	2			+
Affric	I	8	2	2	0	X	N	2,3,10	2			+
More	NWS	6	0-	0-	0	X	N	2,8	2			
Ness	I	6	1	1	0	/+	N	2,3,4,8,11	2			
Rimsdale	NWS	7	0-	0-	0	X	N	2,0	3			
Bad an Loch/nan Clar	NWS	6	0-	0-	0	X	N	4,2	3			
Dunbelchaig	I	7	0-	0-	0	X	N	4,3,0	1			

Area of Search Codes: SES: South East Sutherland
 NWS: North West Sutherland
 WR: West Ross
 C: Caithness
 I: Inverness

*1 NVC communities refers to NVC swamp and tall herb fen (Rodwell in prep.)

*2 Reedswang refers to Scirpus lacustris, Phragmites australis, Phalaris arundinacea and Typha spp.

*3 Damage codes; 0 - Forestry

- 1 - Agricultural pollution
- 2 - Edge trampling
- 3 - Litter
- 4 - Artificial embankment
- 5 - Bird pollution
- 6 - Shooting
- 7 - Weir
- 8 - Sewage
- 9 - Jetty
- 10 - Algae
- 11 - Pleasure craft

All the sites show a variety of substrate types. Six sites (including Loch Maree), did not have any stands of swamp and tall herb fen vegetation. These have been marked with a minus sign. Stands of reedswamp (Phragmites australis, Phalaris arundinacea, Scirpus lacustris and Typha spp.), add conservation interest to a site, as do areas of wetland edge around the loch. Sites having these features have been marked with a plus sign.

All the sites are of natural origin but many have modified catchments. Those sites with a totally semi-natural catchment are indicated by a 'plus'.

All the sites are used or damaged in some way.

Those sites containing five or more species of Potamogeton have been marked with a plus sign. L. Maree contains only two species. This, together with the number of other species found at the site shows L. Maree to be a good typical example of this type. Exceptional examples of type 3 sites usually contain more Potamogeton species.

Murray and Pullar (1910), in their survey of Scottish lochs ranked L. Maree fourth by superficial area, having an area in excess of 1,000 ha (2875 ha). Several other sites within NW Region also have areas over 1,000 ha in size. These are listed in Table 8. Since Murray and Pullar carried out their readings, several sites have been dammed for hydro-electric power generation. Two extra sites within the region are now larger than 1,000 ha (Lochs Quoich and Cluanie). Fluctuating water levels can have severe effects upon the aquatic flora present at a site and sites which suffer draw-down are frequently devoid of aquatic plant life.

Three of these sites (Ness, Morar and Shiel) were included as part of a study of the ecology of Scotland's largest lochs (Maitland et al 1981).

Table 8 sites larger than 1,000 ha in NW Region

Site	Area (ha)
Ness	8409
Maree	2875
*Morar	2667
*Shin	2253
Shiel	1958
*Arkaig	1616
*Lochy	1530
*Quoich	>1000
*Cluanie	>1000

*Denotes site used as source for hydro-electric power generation.

All measurements converted from Murray and Pullar (1910) except Lochs Quoich and Cluanie.

Table 9 Comparison of features for Lochs Morar, Shiel, Ness and Maree

Site	pH	Conductivity umhos	Secchi disc depth m
Morar	6.63 @	35 @	6 - 10 @
		42 d	
	5.70 - 7.10e	34 - 46 e	
Shiel	6.14 @	29 @	5 - 8 @
		47 d	
Ness	6.70 @	30 @	3 - 5 @
Maree	6.28 - 6.57b	39 - 47 b	4.5 b

Sources

@ Maitland et al 1981 (Means of values collected over 12 month period)

b Data obtained for current survey

c Data from Murray and Pullar (1910)

d Data from Ratcliffe (1977)

e Data from Maitland (1989)

Lochs Morar and Shiel have not been surveyed by the NCC team, but from the reports of other Authors (eg Ratcliffe 1977, Maitland et al 1981), they can be identified as examples of type 3 lochs.

Maitland et al (1981) identified L. Ness as the site which received the most human interference. In addition to boating on the loch there is extensive forestry in the catchment. The main aquatic interest of this site is confined to sheltered bays.

Loch Morar is an existing 'Nature Conservation Review' (NCR) grade 1 site, whilst Loch Shiel is an existing NCR grade 2 site (Ratcliffe 1977). Both sites have small catchments for lochs of their size (Maitland et al 1981). Within the NCR these sites are described as examples of ultra-oligotrophic sites. Table 9 shows the range of pH and conductivity values which have been recorded at Lochs Ness, Morar, Maree and Shiel over a period of several years (data from various sources). Also included are secchi disc depths to give an estimation of water clarity. From this it can be seen that the sites are broadly comparable for these features.

Loch Morar had little human influence within the catchment at the time Maitland et al (1981) studied the site, but since then a small salmon hatchery has been set up on the shore of the loch (although this is operating within strict limits, to minimise any impact upon the loch). The site has a small area of forestry within the catchment area and there is a dam on the outflow stream.

Loch Shiel is situated on the border between Inverness and Argyll. In contrast to L. Morar it has a natural outflow stream, but has a greater proportion of forestry within its catchment area than either L. Morar (Maitland et al 1981) or L. Maree.

Loch Maree was not studied by Maitland et al (1981). This site has a generally unmodified catchment, although there is a small area of forestry. Unlike L. Morar, it has a natural outflow and does not have a hatchery on the shores of the

loch, (although there is a fish farm located on a tributary loch).

In conclusion, Lochs Shiel, Morar, Ness and Maree are similar in character. Ness receives the highest level of usage and has the least natural catchment. Loch Shiel has more forestry within the catchment area than L. Morar and L. Maree. L. Morar has an unnatural outflow channel and a fish hatchery. L. Maree has a natural outflow channel and a fish farm sited on a tributary loch.

5. Summary

Loch Maree and four lochans on Eilean Subhainn were surveyed for their macrophyte vegetation. Loch Maree is a typical example of a type 3 oligotrophic site of which there are numerous examples throughout north west Scotland. Two of the small lochans on Eilean Subhainn were also examples of this loch type. Two of the lochans were classified as type 2 lochs.

The conservation interest of Loch Maree in a regional context is also discussed including reference to the work of other Authors.

6. Acknowledgements

Thanks are due to all Landowners who granted access to the surveyors.

Ian Butterfield carried out half of the field work for this report and supplied some of the vegetation descriptions.

Many thanks are also due to the Warden and staff at Beinne Eithe NNR who provided much practical assistance during the survey.

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Appendix 1

Detailed descriptions of each section.

For each section there is a species list, map at a scale of 1:10,000 and a detailed description given below. A total species list for the whole loch is also supplied. Species codes are used on the maps. These codes are defined on the species lists. Where a species was found in large quantities at a site the code has been underlined. If only a small amount was present, the species code has been recorded in brackets.

Section 1 (From Nature Trail car park NH001651 to Inflow of Kinlochewe River NH014645). Edge survey.

The south east end of the loch is sheltered, and is well vegetated. Littorella uniflora forms dominant 'carpets', with Myriophyllum alterniflorum, Glyceria fluitans and Juncus articulatus also present. The several inflows to the loch provide good habitat for Myriophyllum alterniflorum and Glyceria fluitans. Several fen and marsh species are found on the shore in this area including Caltha palustris, Potamogeton polygonifolius, Mentha aquatica, Agrostis stolonifera and Hydrocotyle vulgaris.

Section 2 (From Nature Trail car park NH001651 to inflow of Grudie River NG964685). Edge survey.

Away from the main inflows of the eastern end the shore becomes more exposed and wave-washed, providing little suitable, sheltered habitat for aquatic plants. Boulders and stones are the main substrate, interspersed with sections of bedrock. Much of the shore is bordered by birch/Scots pine woodland.

Aquatic vegetation is scattered, consisting mainly of locally dominant Littorella uniflora with Juncus articulatus and Ranunculus flammula. Much Nitella flexilis var. flexilis was found washed up on the shore.

Section 3 (From west bank of Grudie River NG964685 to Ob nam Muc NG938701). Edge survey.

Similar to section 2. Small promontories of bedrock are interspersed with bays of boulders. Small amounts of Myriophyllum alterniflorum are present

near the promontories, whilst Littorella uniflora, Fontinalis antipyretica, Ranunculus flammula and Juncus articulatus are the most common species in the bays.

Ob Gorm (NG946695), is a small bay dominated by silt and sand. This sheltered area contains Potamogeton natans, Sparganium emersum, Equisetum fluviatile, Littorella uniflora, Lobelia dortmanna and Utricularia intermedia/ochroleuca⁴.

Section 4 (From Ob nam Muc NG938701 to inflow of Talladale River NG919907). Edge survey.

This is similar to the main part of section 3; Littorella uniflora and Ranunculus flammula being the most frequently occurring species. The bays along this section are more sheltered and contain stands of Eleocharis multicaulis and Equisetum fluviatile with Sparganium emersum. Submerged vegetation includes Littorella uniflora, Lobelia dortmanna, Juncus bulbosus var. fluitans and Myriophyllum alterniflorum. Subularia aquatica was found in this section.

Section 5 (Bay by Loch Maree Hotel NG918705 to NG915705). Edge survey.

Some sewage inflow from the hotel is apparent and this is the possible cause of the algal coating which occurs on most of the plants present. Vigorous growth of Littorella uniflora, Callitriche stagnalis, Juncus articulatus and Ranunculus flammula occur.

Section 6 (NG899713 to NG901711). Edge survey.

The shore of this section consists of boulders which constitute an artificial embankment for the car park. There are no plants present.

Section 7 (From Slattadale car park NG889721 to NG881755). Edge survey.

Most of the shore is exposed and the main substrates present are boulders and stones interspersed with sand or bedrock. Littorella uniflora is the

⁴ Work by P.Taylor (pers. com.) has shown that additional species similar in structure to U.intermedia (including U. ochroleuca) also occur in Britain. Early work suggests that little U.intermedia actually occurs in Scotland. The specimens collected at Loch Maree were initially identified as U.intermedia, but are likely to be U.ochroleuca.

most commonly occurring aquatic plant species although Lobelia dortmanna occurs in locally frequent patches in more sheltered areas.

Ob a choir-uidhe (NG882749) is a sheltered bay. Species present include Sparganium emersum, Potamogeton natans, Eleocharis multicaulis, Littorella uniflora, Lobelia dortmanna and Juncus bulbosus var. fluitans.

Section 8 (Tollie Bay NG869781 - NG872785). Edge survey and Section 9 (Inveran NG875785 - NG876784). Edge survey.

The vegetation is similar for both of these sections. Littorella uniflora is the dominant submerged plant with frequently occurring Lobelia dortmanna and occasional Juncus bulbosus var. fluitans. Edge vegetation is mainly Juncus articulatus, Ranunculus flammula and occasional Glyceria fluitans.

Section 10 (North east shore from Kinlochewe River NH013646 to NG983683). Boat survey.

The main concentration of vegetation occurs in the north eastern bay where the loch is shallower and more sheltered.

Juncus bulbosus var. fluitans and Littorella uniflora occur near the shore with Myriophyllum alterniflorum and Nitella flexilis var. flexilis in deeper water. Isoetes lacustris is also occasional in the deeper water.

Much of the northern shore consists of sheer bedrock with no submerged vegetation. Where the shore is made of boulders and shelves less steeply, Myriophyllum alterniflorum is the dominant species. Callitriche hamulata also occurs along this shore.

Section 11 (Around the Islands). Boat survey.

Close to the shores of the islands Lobelia dortmanna and Juncus bulbosus var. fluitans are the most common species. Further from the shore Isoetes lacustris was dominant. An Isoetes hybrid may also be present but this awaits confirmation by A.C.Jermy at the British Museum.

Appendix II Species lists and maps for each section

Site name SECTION 12 Gr No
 Site name Gr No

EMERGENT AND EDGE SPECIES:

SUBMERGED AND FLOATING SPECIES

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR
Ag	Agrostis stolonifera	My1	Hyosotis laxa	Api*	Apium inundatum	Pgr	Potamogeton graminus		DAFOR
Bu	Butomus umbellatus	Msc	Hyosotis scorpiodes	Ba *	Baldellia ranunculoidea	Pn	Potamogeton natans	LF	
Ca	Callitriche palustris	Nas	Nasturtium officinale	Cah	Callitriche hamulata	R	Potamogeton x nitens		
Cx**	Carex aquatilis	Oc	Oenanthe crocata	Cher**	Callitriche hermaphroditica	Pob *	Potamogeton obtusifolius		
Cx1	Carex lasiocarpa	Pa	Phalaris arundinaceae	Cpia	Callitriche platycarpa	Ppec*	Potamogeton pectinatus		
Cx2	Carex limosa	Pha*	Phragmites australis	Ca5	Callitriche stagnalis	Pper	Potamogeton perfoliatus		
Cx3	Carex nigra	Pop	Potentilla palustris	Ec	Elodea canadensis	Ppra**	Potamogeton praelangus		
Cx4	Carex rostrata	Rfl	Ranunculus flammula	Fon	Fontinalis antipyretica	Ppol	Potamogeton polygonifolius	LF	
Cx5	Carex vesicaria	Sl	Scirpus lacustris	Hip	Hippuris vulgaris	Ppu *	Potamogeton pusillus		
Ele	Eleocharis multicaulis	St*	Scirpus tabernaemontanae	Hyd	Hydrocotyle vulgaris	Pr **	Potamogeton rutilus		
Ele	Eleocharis quinqueflora	St*	Scirpus tabernaemontanae	Isl	Isoetes lacustris	Pxz	Potamogeton x zizii		
Ele	Eleocharis palustris	Sper	Sparaganium erectum	Iss **	Isoetes (Festacea) echinospora	Ra *	Ranunculus aquatilis		
Er	Eriophorum angustifolium	Spem	Sparaganium emersum	Jb	Juncus bulbosus var fluitans	RP *	Ranunculus peltatus		
Gl	Glyceria fluitans	TI*	Typha latifolia	Lm *	Lemma minor	Rt *	Ranunculus trichophyllus		
Hip	Hippuris vulgaris	Vb	Veronica beccabunga	Lit	Littorella uniflora	LA	Scirpus fluitans		
Hy	Hydrocotyle vulgaris	Vaa*	Veronica anagallis-aquatica	Lob	Lobelia dortmanna	R	Sparganium angustifolium		
Ip	Iris pseudacorus	Va	Veronica scutellata	Lur	Luronium natans	Spmi	Sparganium minimum		
Ja	Juncus articulatus	Ef	Equisetum fluviatile	Mal	Myriophyllum alterniflorum	Sub **	Subularia aquatica		
Jb	Juncus bulbosus	EF	Equisetum sylvaticum	Map	Myriophyllum spicatum	Utl	Utricularia intermedia		
Jc	Juncus conglomeratus	EF	Equisetum sylvaticum	Na	Nymphaea alba	Um	Utricularia minor		
Je	Juncus effusus	Species total	Other edge species	Nup **	Nuphar pumila	Uva	Utricularia vulgaris/australis		
Li	Littorella uniflora	Carex demissa	Carex demissa	Pil **	Piluria globulifera	Une	Utricularia neglecta		
Ly	Lycopodiella inundata	Carex echinata	Carex echinata	Pam	Polygonum amphibium	Zan *	Zannichellia palustris		
Ly	Lythrum portula	Carex panicea	Carex panicea	Ph	Polygonum hydrophyllum	Cha	Chara sp		
Ma	Mentha aquatica	Carex paniculata	Carex paniculata	Pal	Potamogeton alpinus	Nit	Nitella sp		
Mt	Menyanthes trifoliata	Senecio aquaticus	Senecio aquaticus	Pbe	Potamogeton berchtoldii	Species total	Species total		
Mg	Mimulus guttatus	Triglochin palustris	Triglochin palustris	Pcr *	Potamogeton crispus				
Ml	Mimulus luteus	Viola palustris	Viola palustris	Pfr **	Potamogeton friesii				
Mon	Montia fontana	Species requiring special protection within the HRPB area (Palmer & Newbold 1977)	Species requiring special protection within the HRPB area (Palmer & Newbold 1977)	Pfl **	Potamogeton filiformis				

Site name No.
 Site name **SECTIONS 3, 4 & 5**. Gr No.
SEE MAPS C + D (NO MAP FOR SECTION 5)

EMERGENT AND EDGE SPECIES:		SUBMERGED AND FLOATING SPECIES	
Map code	DAFOR	Map code	DAFOR
Ag	Agrostis stolonifera	Api*	Apium inundatum
Bu	Butomus umbellatus	Ba *	Baldellia ranunculoides
Ca	Caltha palustris	Cah	Callitriche hamulata
Cx	Carex aquatilis	Cher**	Callitriche hermaphroditica
Cx	Carex lasiocarpa	Cpla	Callitriche platycarpa
Cx	Carex limosa	Ca5	Callitriche stagnalis
Cx	Carex nigra	Ec	Elodea canadensis
Cx	Carex rostrata	Fon	Fontinalis antipyretica
Cx	Carex vesicaria	Hip	Hippuris vulgaris
El	Eleocharis multicaulis	Hyd	Hydrocotyle vulgaris
El	Eleocharis palustris	Isl	Isoetes lacustris
Er	Eriophorum angustifolium	Iss **	Isoetes (setacea) echinospora
Gl	Glyceria fluitans	Jb	Juncus bulbosus var fluitans
Hip	Hippuris vulgaris	Lm *	Lemna minor
Hy	Hydrocotyle vulgaris	Lit	Littorella uniflora
Ip	Iris pseudacorus	Lob	Lobelia dortmanna
Ja	Juncus articulatus	Lur	Luronium natans
Jb	Juncus bulbosus	Mal	Myriophyllum alterniflorum
Jc	Juncus conglomeratus	Msp	Myriophyllum spicatum
Je	Juncus effusus	Na	Nymphaea alba
L	Littorella uniflora	Nup **	Nuphar pumila
Ly	Lycopodiella inundata	Pil **	Piluria globulifera
Ly	Lythrum portula	Pam	Polygonum amphibium
Ma	Mentha aquatica	Ph	Polygonum hydropiper
M	Menyanthes trifoliata	Pal	Potamogeton alpinus
Mg	Mimulus guttatus	Pbe	Potamogeton bertholdii
Ml	Mimulus luteus	Pcr *	Potamogeton crispus
Mon	Montia fontana	Pfr **	Potamogeton friesii
		Pfil **	Potamogeton filiformis
			Species total

* species requiring special protection within the HRPB area (Palmer & Newbold 1977)
 ** species occurring in less than 100 10 x 10 km squares in Great Britain.

Site name **LOCHAN...A**..... Gr No. Cr No

SUBMERGED AND FLOATING SPECIES

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR
A	My1	Myosotis laxa	.....	Api*	Apium inundatum	.....	Pgr	Potamogeton graminus	.....
B	Msc	Myosotis scorpiodes	.....	Ba *	Baldellia ranunculoidea	.....	Pn	Potamogeton natans	.....
C	Nas	Nasturtium officinale	.....	Cah	Callitriche hamulata	.....	LF..	Potamogeton x nitens	.....
C	Oc	Oenanthe crocata	.....	Cher**	Callitriche hermaphroditica	.....	Pob *	Potamogeton obtusifolius	.....
C	Pa	Phalaris arundinacea	.....	Cpla	Callitriche platycarpa	.....	Ppec*	Potamogeton pectinatus	.....
C	Pha*	Phragmites australis	.....	Ca5	Callitriche stagnalis	.....	LF..	Potamogeton perfoliatus	.....
C	Pop	Potentilla palustris	.....	Ec	Elodea canadensis	.....	Ppra**	Potamogeton praelangus	.....
C	Rfl	Ranunculus flammula	.....	Fon	Fontinalis antipyretica	.....	Q..	Potamogeton polygonifolius	LF..
C	S1	Scirpus lacustris	.....	Hip	Hippuris vulgaris	.....	Ppu *	Potamogeton pusillus	.....
E	St*	Scirpus tabernaemontanae	.....	Hyd	Hydrocotyle vulgaris	.....	Pr **	Potamogeton rutilus	.....
E	Sper	Sparganium erectum	.....	Isl	Isoetes lacustris	.....	Pxz	Potamogeton x zizzi	.....
E	Spem	Sparganium emersum	.....	Iss **	Isoetes (etacea) zickingspora	.....	Ra *	Ranunculus aquatilis	.....
G	T1*	Typha latifolia	.....	Jb	Juncus bulbosus var fluitans	.....	LA	Ranunculus peltatus	.....
H	Vb	Veronica beccabunga	.....	Lm *	Lemna minor	.....	Rt *	Ranunculus trichophyllus	.....
H	Vaa*	Veronica anagallis-aquatica	.....	Lit	Littorella uniflora	.....	LA	Scirpus fluitans	LA.
I	Vs	Veronica scutellata	.....	Lob	Lobelia dortmanna	.....	LA	Sparganium angustifolium	.....
J	Ef	Equisetum fluviatile	.....	Lur	Luronium natans	.....	Spmi	Sparganium minimum	Q..
J	Ep	Equisetum palustre	.....	Mal	Myriophyllum alterniflorum	.....	Q..	Subularia aquatica	.....
J	DSE	DESCHAMPSIA SCHNEEA LF	.....	Msp	Myriophyllum spicatum	.....	Utl	Utricularia intermedia	LA.
J	F..	Species total	.....	Na	Nymphaea alba	.....	Q..	Utricularia minor	.....
L	LF..	Other edge species	.....	Nup **	Nuphar pumila	.....	Uva	Utricularia vulgaris/australis	Q..
L	Cxd	Carex demissa	.....	Pil **	Pilularia globulifera	.....	Une	Utricularia neglecta	.....
L	Cxe	Carex echinata	.....	Pam	Polygonum amphibium	.....	Zan *	Zannichellia palustris	.....
M	Cxp	Carex panicea	.....	Ph	Polygonum hydropiper	.....	Cha	Chara sp	.....
M	Cxpa	Carex paniculata	.....	Pal	Potamogeton alpinus	.....	Nit	Nitella sp	.....
M	Sa	Senecio aquaticus	.....	Pbe	Potamogeton bertholdii	.....	Species total		.....
M	Tp	Triglochin palustris	.....	Pcr *	Potamogeton crispus	.....	#Ela	Elatine hexandra	LA.
Mon	Vp	Viola palustris	.....	Pfr **	Potamogeton friesii	.....			.....
*		species requiring special protection within the HRPB area (Palmer & Newbold 1977)	.....	Pp1 **	Potamogeton filiformis	.....			.....

Site name **LOXMAN B** Gr No Cr No

SEE MAP L

EMERGENT AND EDGE SPECIES:

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	
Ag	Agrostis stolonifera	..... Myl	Myosotis laxa	.....	Api*	Apium inundatum	.....	Pgr	Potamogeton graminus	.....	DAFOR									
Bu	Butomus umbellatus	..... Msc	Myosotis scorpiodes	.....	Ba *	Baldellia ranunculoides	.....	Pn	Potamogeton natans	.....									
Ca	Caltha palustris	..... Nas	Nasturtium officinale	.....	Cah	Callitriche hamulata	.....	Pxn	Potamogeton x nitens	.....									
Cx**	Carex aquatilis	..... Oc	Oenanthe crocata	.....	Cher**	Callitriche hermaphroditica	.....	Pob *	Potamogeton obtusifolius	.....									
Cx	Carex lasiocarpa	..... Pa	Phalaris arundinaceae	.....	Cpla	Callitriche platycarpa	.....	Ppec*	Potamogeton pectinatus	.....									
Cx	Carex limosa	..... Pha*	Phragmites australis	.....	Ca5	Callitriche stagnalis	.....	Pper	Potamogeton perfoliatus	.....									
Cx	Carex nigra	..... Q...	Potentilla palustris	.....	Ec	Elodea canadensis	.....	Ppra**	Potamogeton praelangus	.....									
Cx	Carex rostrata	..... Rf1	Ranunculus flammula	.....	Fon	Fontinalis antipyretica	.....	Ppol	Potamogeton polygonifolius	LF..										
Cx	Carex vesicaria	..... S1	Scirpus lacustris	.....	Hip	Hippuris vulgaris	.....	Ppu *	Potamogeton pusillus	.....									
E	Eleocharis multicaulis	..... LA. St*	Scirpus tabernaemontanae	.....	Hyd	Hydrocotyle vulgaris	.....	Pr **	Potamogeton rutilus	.....									
E	Eleocharis palustris	.....	Sparganium erectum	.....	Isl	Isoetes lacustris	.....	Pxz	Potamogeton x tizzi	.....									
E	Eriophorum angustifolium	..... Sper	Sparganium emersum	.....	Iss **	Isoetes (setacea) ACHINOSPORA	.....	Ra *	Ranunculus aquatilis	.....									
G	Glyceria fluitans	..... LF..	Typha latifolia	.....	Jb	Juncus bulbosus var fluitans	LF..	RP *	Ranunculus peitatus	.....									
H	Hippuris vulgaris	..... T1*	Veronica beccabunga	.....	Lm *	Lemna minor	.....	Rt *	Ranunculus trichophyllus	.....									
H	Hydrocotyle vulgaris	..... Vb	Veronica anagallis-aquatica	.....	Lit	Littorella uniflora	LF..	Sf	Scirpus fluitans	.....									
I	Iris pseudacorus	..... Vaa*	Veronica scutellata	.....	Lob	Lobelia dortmanna	LF..	Spa	Sparganium angustifolium	.....									
J	Juncus articulatus	..... Vs	Equisetum fluviatile	.....	Lur	Luronium natans	.....	Spmi	Sparganium minimum	LF..										
J	Juncus bulbosus	..... Ef	Equisetum palustre	.....	Mal	Myriophyllum alterniflorum	.....	Sub **	Subularia aquatica	.....									
J	Juncus conglomeratus	..... LF..	Species total	.....	Msp	Myriophyllum spicatum	LF..	Uti	Utricularia intermedia	.....									
J	Juncus effusus	..... LF..	Other edge species	.....	Na	Nymphaea alba	.....	Um	Utricularia minor	.....									
L	Littorella uniflora	.....	Carex demissa	.....	Nup **	Nuphar pumila	.....	Uva	Utricularia vulgaris/australis	.....									
L	Lycopodiella inundata	..... Cxd	Carex echinata	.....	Pil **	Pilularia globulifera	.....	Une	Utricularia neglecta	.....									
L	Lythrum portula	..... Cxe	Carex panicea	.....	Pam	Polygonum amphibium	.....	Zan *	Zannichellia palustris	.....									
M	Mentha aquatica	..... Cxp	Carex paniculata	.....	Ph	Polygonum hydropiper	.....	Cha	Chara sp	.....									
M	Menyanthes trifoliata	..... Cxpa	Senecio aquaticus	.....	Pal	Potamogeton alpinus	.....	Nit	Nitella sp	.....									
M	Mimulus guttatus	..... Sa	Triglochin palustris	.....	Pbe	Potamogeton berchtoldii	.....	Species total	.....	.....								
M	Mimulus luteus	..... Tp	Viola palustris	.....	Pcr *	Potamogeton crispus	.....	.....	.....	.....						
Mon	Montia fontana	..... Vp	Species requiring special protection within the HRPB area (Palmer & Newbold 1977)	.....	Pfr **	Potamogeton friesii	.....	.....	.....	.....						
Mon	Species occurring in less than 100 10 x 10 km squares in Great Britain.	.....		.....	Pfl **	Potamogeton filiformis	.....	.....	.....	.....						

Site name Gr No

Site name **LOGMAN . S .** Gr No

SEE MAP N

SUBMERGED AND FLOATING SPECIES:

SUBMERGED AND FLOATING SPECIES

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR
Ag	Agrostis stolonifera	..... Myl	Myosotis laxa	..... Myl	Myosotis laxa	..... Myl	Myosotis laxa	..... Myl	Myosotis laxa	..... Myl	Myosotis laxa	..... Myl	Myosotis laxa
B	Butomus umbellatus	..... Mac	Myosotis scorpiodes	..... Mac	Myosotis scorpiodes	..... Mac	Myosotis scorpiodes	..... Mac	Myosotis scorpiodes	..... Mac	Myosotis scorpiodes	..... Mac	Myosotis scorpiodes
C	Caltha palustris	..... Nas	Nasturtium officinale	..... Nas	Nasturtium officinale	..... Nas	Nasturtium officinale	..... Nas	Nasturtium officinale	..... Nas	Nasturtium officinale	..... Nas	Nasturtium officinale
Ca**	Carex aquatilis	..... Oc	Oenanthe crocata	..... Oc	Oenanthe crocata	..... Oc	Oenanthe crocata	..... Oc	Oenanthe crocata	..... Oc	Oenanthe crocata	..... Oc	Oenanthe crocata
Ct	Carex lasiocarpa	..... Pa	Phalaris arundinaceae	..... Pa	Phalaris arundinaceae	..... Pa	Phalaris arundinaceae	..... Pa	Phalaris arundinaceae	..... Pa	Phalaris arundinaceae	..... Pa	Phalaris arundinaceae
Ct1	Carex limosa	..... Pha*	Phragmites australis	..... Pha*	Phragmites australis	..... Pha*	Phragmites australis	..... Pha*	Phragmites australis	..... Pha*	Phragmites australis	..... Pha*	Phragmites australis
C	Carex nigra	..... Pop	Potentilla palustris	..... Pop	Potentilla palustris	..... Pop	Potentilla palustris	..... Pop	Potentilla palustris	..... Pop	Potentilla palustris	..... Pop	Potentilla palustris
C	Carex rostrata	..... Rfl	Ranunculus flammula	..... Rfl	Ranunculus flammula	..... Rfl	Ranunculus flammula	..... Rfl	Ranunculus flammula	..... Rfl	Ranunculus flammula	..... Rfl	Ranunculus flammula
Ca	Carex vesicaria	..... Sl	Scirpus lacustris	..... Sl	Scirpus lacustris	..... Sl	Scirpus lacustris	..... Sl	Scirpus lacustris	..... Sl	Scirpus lacustris	..... Sl	Scirpus lacustris
Ca	Eleocharis multicaulis	..... St*	Scirpus tabernaemontanae	..... St*	Scirpus tabernaemontanae	..... St*	Scirpus tabernaemontanae	..... St*	Scirpus tabernaemontanae	..... St*	Scirpus tabernaemontanae	..... St*	Scirpus tabernaemontanae
Ca	Eleocharis palustris	..... Sper	Sparganium erectum	..... Sper	Sparganium erectum	..... Sper	Sparganium erectum	..... Sper	Sparganium erectum	..... Sper	Sparganium erectum	..... Sper	Sparganium erectum
Ca	Eriophorum angustifolium	..... Spem	Sparganium emersum	..... Spem	Sparganium emersum	..... Spem	Sparganium emersum	..... Spem	Sparganium emersum	..... Spem	Sparganium emersum	..... Spem	Sparganium emersum
Ca	Glyceria fluitans	..... Tl*	Typha latifolia	..... Tl*	Typha latifolia	..... Tl*	Typha latifolia	..... Tl*	Typha latifolia	..... Tl*	Typha latifolia	..... Tl*	Typha latifolia
Ca	Hippuris vulgaris	..... Vb	Veronica beccabunga	..... Vb	Veronica beccabunga	..... Vb	Veronica beccabunga	..... Vb	Veronica beccabunga	..... Vb	Veronica beccabunga	..... Vb	Veronica beccabunga
Ca	Hydrocotyle vulgaris	..... Vaa*	Veronica anagallis-aquatica	..... Vaa*	Veronica anagallis-aquatica	..... Vaa*	Veronica anagallis-aquatica	..... Vaa*	Veronica anagallis-aquatica	..... Vaa*	Veronica anagallis-aquatica	..... Vaa*	Veronica anagallis-aquatica
Ca	Iris pseudacorus	..... Vs	Veronica scutellata	..... Vs	Veronica scutellata	..... Vs	Veronica scutellata	..... Vs	Veronica scutellata	..... Vs	Veronica scutellata	..... Vs	Veronica scutellata
Ca	Juncus articulatus	..... Ef	Equisetum fluviatile	..... Ef	Equisetum fluviatile	..... Ef	Equisetum fluviatile	..... Ef	Equisetum fluviatile	..... Ef	Equisetum fluviatile	..... Ef	Equisetum fluviatile
Ca	Juncus bulbosus	..... Ep	Equisetum palustre	..... Ep	Equisetum palustre	..... Ep	Equisetum palustre	..... Ep	Equisetum palustre	..... Ep	Equisetum palustre	..... Ep	Equisetum palustre
Ca	Juncus conglomeratus	..... Lf	Species total	..... Lf	Species total	..... Lf	Species total	..... Lf	Species total	..... Lf	Species total	..... Lf	Species total
Ca	Juncus effusus	..... Cxd	Other edge species	..... Cxd	Other edge species	..... Cxd	Other edge species	..... Cxd	Other edge species	..... Cxd	Other edge species	..... Cxd	Other edge species
Ca	Littorella uniflora	..... Cxe	Carex demissa	..... Cxe	Carex demissa	..... Cxe	Carex demissa	..... Cxe	Carex demissa	..... Cxe	Carex demissa	..... Cxe	Carex demissa
Ca	Lycopodiella inundata	..... Cxp	Carex echinata	..... Cxp	Carex echinata	..... Cxp	Carex echinata	..... Cxp	Carex echinata	..... Cxp	Carex echinata	..... Cxp	Carex echinata
Ca	Lythrum portula	..... Cxp	Carex panicea	..... Cxp	Carex panicea	..... Cxp	Carex panicea	..... Cxp	Carex panicea	..... Cxp	Carex panicea	..... Cxp	Carex panicea
Ca	Mentha aquatica	..... Cxpa	Carex paniculata	..... Cxpa	Carex paniculata	..... Cxpa	Carex paniculata	..... Cxpa	Carex paniculata	..... Cxpa	Carex paniculata	..... Cxpa	Carex paniculata
Ca	Menyanthes trifoliata	..... Sa	Senecio aquaticus	..... Sa	Senecio aquaticus	..... Sa	Senecio aquaticus	..... Sa	Senecio aquaticus	..... Sa	Senecio aquaticus	..... Sa	Senecio aquaticus
Ca	Mimulus guttatus	..... Tp	Triglochin palustris	..... Tp	Triglochin palustris	..... Tp	Triglochin palustris	..... Tp	Triglochin palustris	..... Tp	Triglochin palustris	..... Tp	Triglochin palustris
Ca	Mimulus luteus	..... Vp	Viola palustris	..... Vp	Viola palustris	..... Vp	Viola palustris	..... Vp	Viola palustris	..... Vp	Viola palustris	..... Vp	Viola palustris
Ca	Montia fontana	..... Pp	Potamogeton frutescens	..... Pp	Potamogeton frutescens	..... Pp	Potamogeton frutescens	..... Pp	Potamogeton frutescens	..... Pp	Potamogeton frutescens	..... Pp	Potamogeton frutescens
Ca	Montia fontana	..... Pp1	Potamogeton filliformis	..... Pp1	Potamogeton filliformis	..... Pp1	Potamogeton filliformis	..... Pp1	Potamogeton filliformis	..... Pp1	Potamogeton filliformis	..... Pp1	Potamogeton filliformis

Uti... ..
 Uva... ..
 Une... ..
 Zan*... ..
 Cha... ..
 Nit... ..
 Species total

* species requiring special protection within the HRP areas (Palmer & Newbold 1977)
 ** species occurring in less than 100 10 x 10 m squares in Great Britain.

Site name **LOCHAN, D.** Gr No

Site name **LOCHAN, D.** Gr No

SEE MAP N

SUBMERGED AND FLOATING SPECIES

EMERGENT AND EDGE SPECIES

Map code	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR		
Agrostis stolonifera	Myosotis laxa	.....	Api*	Apium inundatum	.....	Pgr	Potamogeton graminus	.....
Butomus umbellatus	Myosotis scorpiodes	.....	Ba *	Baldellia ranunculoidea	.....	Pn	Potamogeton natans	.....
Caltha palustris	Nasturtium officinale	.....	Cah	Callitriche hamulata	.....	Pxn	Potamogeton x nitens	.....
Carex aquatilis	Oenanthe crocata	.....	Cher**	Callitriche hermaphroditica	.....	Pob *	Potamogeton obtusifolius	.....
Carex lasiocarpa	Phalaris arundinaceae	.....	Cpla	Callitriche platycarpa	.....	Ppec*	Potamogeton pectinatus	.....
Carex limosa	Phragmites australis	.....	Ca5	Callitriche stagnalis	.....	Pper	Potamogeton perfoliatus	.....
Carex nigra	Potentilla palustris	.....	Ec	Elodea canadensis	.....	Ppra**	Potamogeton praelangus	.....
Carex rostrata	Ranunculus flammula	.....	Fon	Fontinalis antipyretica	.....	Ppol	Potamogeton polygonifolius	LF.
Carex vesicaria	Scirpus lacustris	.....	Hip	Hippuris vulgaris	.....	Ppu *	Potamogeton pusillus	.....
Eleocharis multicaulis	Scirpus tabernaemontanae	.....	Hyd	Hydrocotyle vulgaris	.....	Pr **	Potamogeton rutillus	.....
Eleocharis palustris	Sparganium erectum	.....	Isl	Isoetes lacustris	.....	Pxz	Potamogeton x zizzi	.....
Eriophorum angustifolium	Sparganium emergum	.....	Iss **	Isoetes (setacea) ecchinospora	.....	Ra *	Ranunculus aquatilis	.....
Glyceria fluitans	Typha latifolia	.....	Jb	Juncus bulbosus var fluitans	.....	RP *	Ranunculus peltatus	.....
Hippuris vulgaris	Veronica beccabunga	.....	Lm *	Lemna minor	.....	Rt *	Ranunculus trichophyllus	.....
Hydrocotyle vulgaris	Veronica anagallis-aquatica	.....	Lit	Littorella uniflora	.....	Sf	Scirpus fluitans	LF.
Iris pseudacorus	Veronica scutellata	.....	Lob	Lobelia dortmanna	.....	Spa	Sparganium angustifolium	.....
Juncus articulatus	Equisetum fluviatile	.....	Lur	Luronium natans	.....	Spmi	Sparganium minimum	.....
Juncus bulbosus	Equisetum palustre	.....	Mal	Myriophyllum alterniflorum	.....	Sub **	Subularia aquatica	.....
Juncus conglomeratus	Species total	.....	Msp	Myriophyllum spicatum	.....	Uti	Utricularia intermedia	.....
Juncus effusus	Other edge species	.....	Na	Nymphaea alba	LF.	Um	Utricularia minor	O.
Littorella uniflora	Carex demissa	.....	Nup **	Nuphar pumila	.....	Dva	Utricularia vulgaris/australis	.....
Lycopodiella inundata	Carex echinata	.....	Pil **	Pilularia globulifera	.....	Une	Utricularia neglecta	.....
Lythrum portula	Carex panicea	.....	Pam	Polygonum amphibium	.....	Zan *	Zannichellia palustris	.....
Mentha aquatica	Carex paniculata	.....	Ph	Polygonum hydrophiper	.....	Cha	Chara sp	.....
Menyanthes trifoliata	Senecio aquaticus	.....	Pal	Potamogeton alpinus	.....	Nit	Nitella sp	.....
Mimulus guttatus	Triglochin palustris	.....	Pbe	Potamogeton bertholdii	.....	Species total	.....	.....
Mimulus luteus	Viola palustris	.....	Pcr *	Potamogeton crispus	.....	.....	.....	.....
Montia fontana	.....	.....	Pfr **	Potamogeton friesii	.....	.....	.....	.....
.....	.....	.....	Pfil **	Potamogeton filliformis	.....	.....	.....	.....

* species requiring special protection within the HRPB area (Palmer & Newbold 1977)
 ** species occurring in less than 100 10 x 10 km squares in Great Britain.

Site name ALL SECTIONS... Gr No.

EMERGENT AND EDGE SPECIES:

SUBMERGED AND FLOATING SPECIES

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR
Ags	..... Myl	Api*	..... Pgr	Map code	DAFOR	Map code	DAFOR
Bu	..... Masc	Ba *	..... Pn	Apium inundatum	.....	Potamogeton graminus	.....
Cap	..... Nas	Cah	..... Pxn	Baldellia ranunculoidea	.....	Potamogeton natans	.....
Cxa**	..... Oc	Cher**	..... Pob *	Callitriche hamulata	.....	Potamogeton x nitens	.....
Cx1	..... Pa	Cpia	..... Ppec*	Callitriche hermaphroditica	.....	Potamogeton obtusifolius	.....
Cx11	..... Pha*	Ca5	..... Pper	Callitriche stagnalis	.....	Potamogeton pectinatus	.....
Cx12	..... Pop	Ec	..... Ppra**	Elodea canadensis	.....	Potamogeton perfoliatus	.....
Cx13	..... Rfl	Fon	..... Ppol	Fontinalis antipyretica	.....	Potamogeton praelangus	.....
Cx14	..... S1	Hip	..... Ppu *	Hippuris vulgaris	.....	Potamogeton polygonifolius	.....
Cx15	..... St*	Hyd	..... Pr **	Hydrocotyle vulgaris	.....	Potamogeton pusillus	.....
Cx16	..... Sper	Isl	..... Pxz	Isoetes lacustris	.....	Potamogeton tutilus	.....
Cx17	..... Spem	Ias **	..... Ra *	Isoetes setacea	.....	Potamogeton x tizzi	.....
Cx18	..... Tl*	Jb	..... RP *	I. SPACES PRO AGRI TYPE	.....	Ranunculus aquatilis	.....
Cx19	..... Vb	Lm *	..... Rt *	Juncus bulbosus var fluitans	.....	Ranunculus peltatus	.....
Cx20	..... Vas*	Lit	..... Sf	Lemna minor	.....	Ranunculus trichophyllus	.....
Cx21	..... Vs	Lob	..... Spa	Littorella uniflora	.....	Scirpus fluitans	.....
Cx22	..... Ef	Lur	..... Spml	Lobelia dortmanna	.....	Sparganium angustifolium	.....
Cx23	..... Ep	Mal	..... Sub **	Luronium natans	.....	Sparganium minimum	.....
Cx24	..... Dsc	Map	..... Uti	Myriophyllum alterniflorum	.....	Subularia aquatica	.....
Cx25	..... Cxd	Na	..... Um	Myriophyllum spicatum	.....	Utricularia intermedia	.....
Cx26	..... Cxe	Nup **	..... Uva	Nymphaea alba	.....	Utricularia minor	.....
Cx27	..... Cxp	Pil **	..... Une	Nuphar pumila	.....	Utricularia vulgaris/ australis	.....
Cx28	..... Cxpa	Pam	..... Zan *	Piluria globulifera	.....	Utricularia neglecta	.....
Cx29	..... Sa	Ph	..... Cha	Polygonum amphibium	.....	Zannichellia palustris	.....
Cx30	..... Tp	Pal	..... Mit	Polygonum hydropiper	.....	Chara sp	.....
Cx31	..... Vp	Pbe	..... Species total	Potamogeton alpinus	.....	Nitella sp <i>flexilis</i>	.....
Cx32	.....	Per *	.....	Potamogeton berchtoldii	.....	<i>var fusca</i> "opaca" WINE	.....
Cx33	.....	Pfr **	.....	Potamogeton crispus	.....	<i>var fusca</i> "opaca" WINE	.....
Cx34	.....	Pfl **	.....	Potamogeton friesii	.....	(ID T.M. MOORE)	.....
Cx35	.....		.....	Potamogeton filiformis	.....		.....

* species requiring special protection within the HRPB area (Palmer & Newbold 1977)
 ** species occurring in less than 100 10 x 10 km squares in Great Britain.

5000m

LOCH MAREE

Winter water level 10 metres above Newlyn datum. Mean

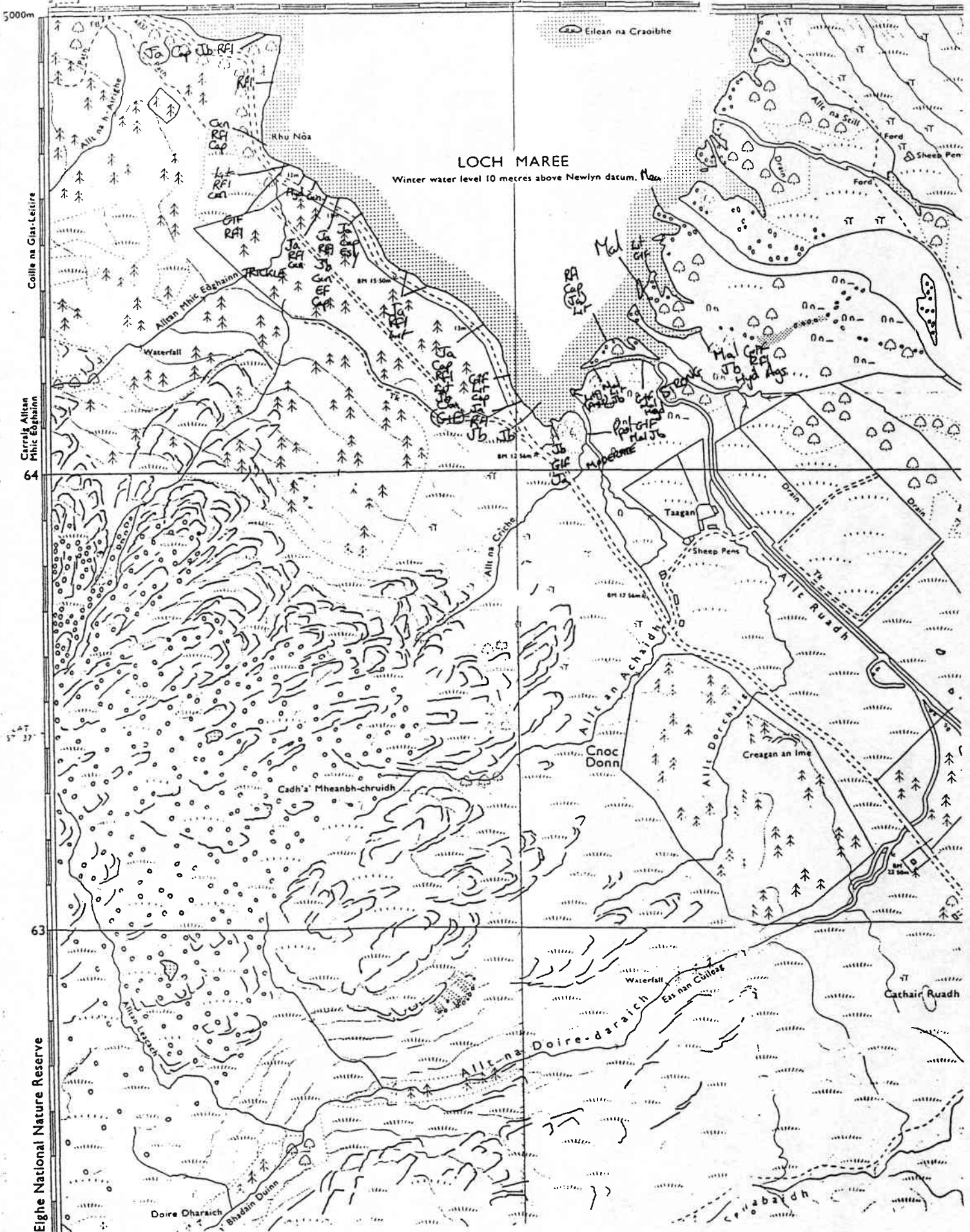
Carrig Alltan Mhic Eoghainn
64

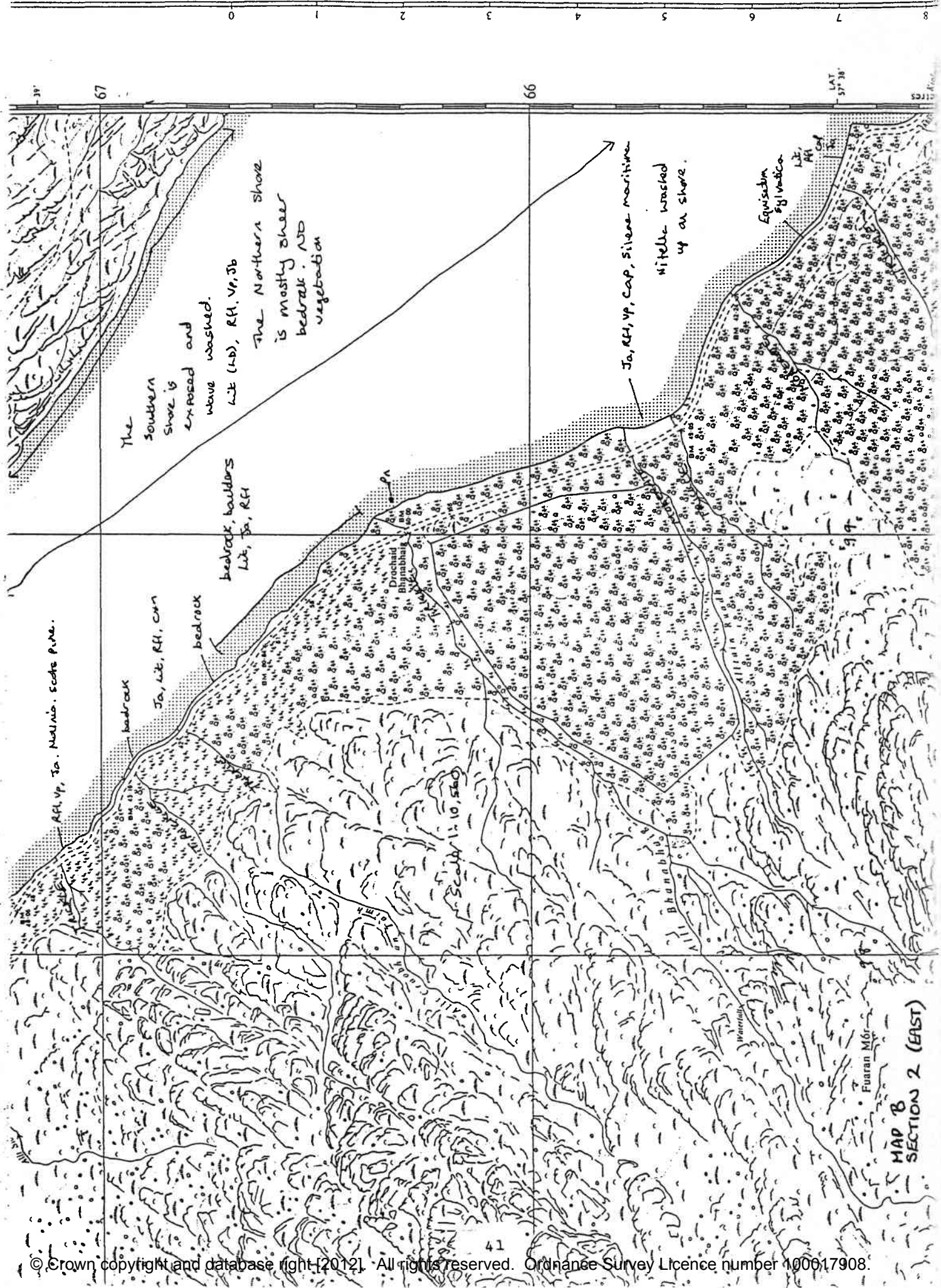
57 37

63

Eighe National Nature Reserve

SECTION I MAP A





67

66

LAT 57 38

APL, VP, JA. N. Mainis. Scots P.Ne.

The Southern shore is exposed and wave washed.
 LT (LD), RH, VP, JB
 The Northern shore is mostly sheer bedrock. NO vegetation.

JA, RH, VP, CAP, Silene maritime
 Nitella washed up on shore.

bedrock, boulders
 LT, JA, RH

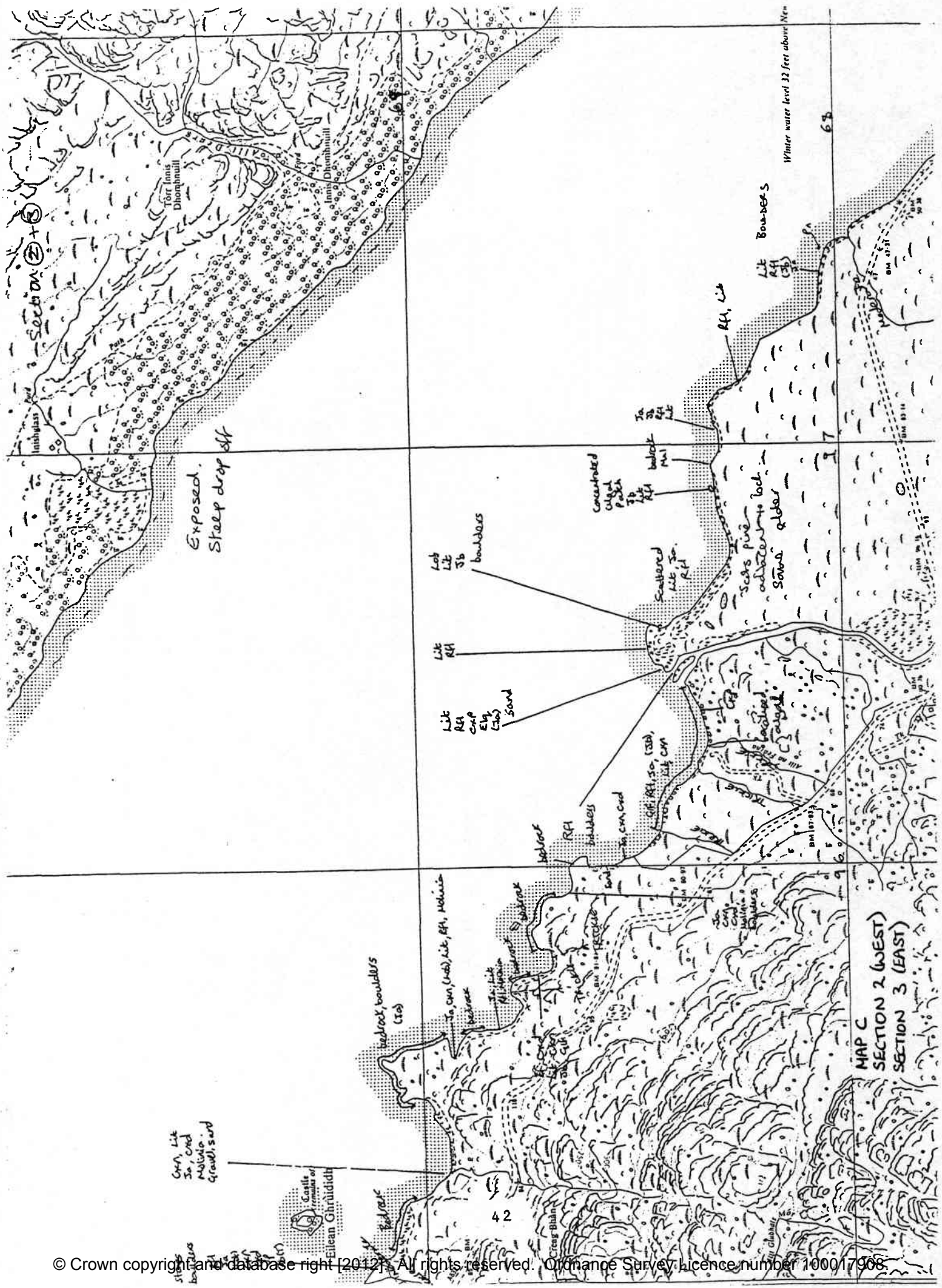
bedrock
 JA, LT, RH, CAP

Droichaid Bhranbhaid

Equisetum sylvaticum

Scale 1:10,560

MAP B
 SECTION 2 (EAST)



Winter water level 32 feet above Mean

Exposed.
Steep drop off

Lit
R4
cap
Ely
(low)
sand

Lit
R4

Lit
L1
L2
L3
boulders

concentrated
caliche
patches

scattered
lichen

scars pure
calcareous rock
sand & silt

Bombers

Cap, Lit
In, Cap
Mudstone
Gravel, sand

Castle
remains of
Eilean Ghruididh

bedrock, boulders
(low)

In, Cap, (low), lit, R4, Molinia

42

MAP C
SECTION 2 (WEST)
SECTION 3 (EAST)



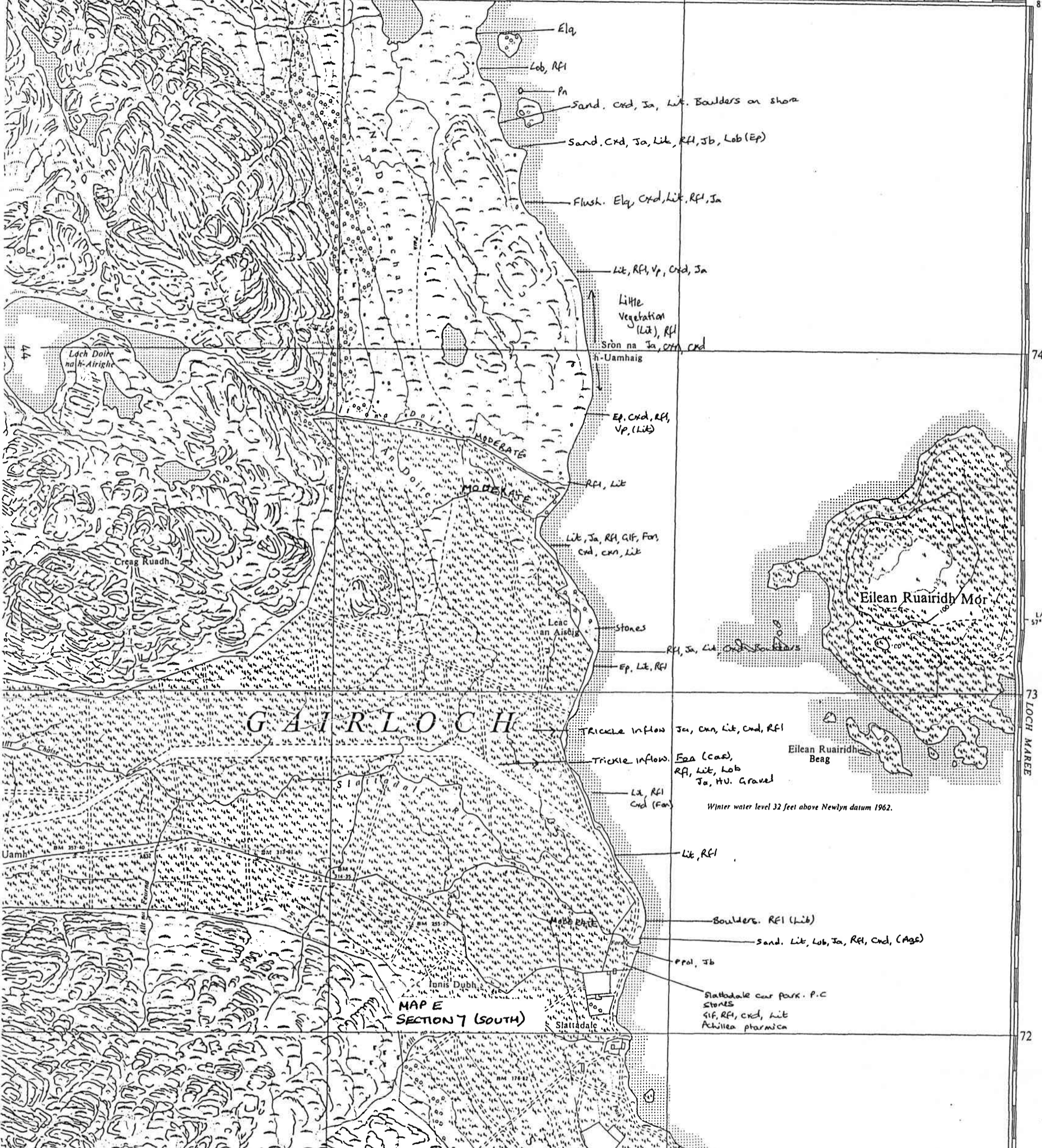
- SECTION 4
TARGET NOTES
- 1 Pool
 - 2 csn, Elm, Lt, 3a, Lab, Lt
 - 3 Era
 - 4 3b, 3a, Ef
 - 5 Lab, 3b (nat)
 - 6 Lt, Lab, csn, 3a
 - 7 Lt, Lab, Ef, 3b
 - 8 RH
 - 9 Lab, Lt
 - 10 Lt, Lab, 3b
 - 11 Lt, Lab, RH, csn
 - 12 csn, Lt, Ef, 3b
 - 13 3a, RH, Elm, Ef, Lt
 - 14 Lt, Lab, RH

- 15 Elm, Lab, 3b
- 16 RH, Lab, 3a (Ef)
- 17 Lt, Lab, Elm, Dec, nat
- 18 3a, csn

- SECTION 3 (WEST)
TARGET NOTES
- 1 Pool with Ef, 3b, CM, uh, cse
 - 2 Ef, Lab, sperm, c/f, Ea, 3b
 - 3 Lt, 3b, Csn, Ef, Lab, Rh, Ea, uh, RH, cse, (nat)
 - 4 uh, Ef, csn, Lab
 - 5 sand, Lt, 3a, RH, Lab, sperm, 3b
 - 6 Lt, RH, csn, 3a
 - 7 Bedrock (3a)
 - 8 Lt, RH, csn, 3a
 - 9 gravel, stones, sand, boulders, 3b, Lt, Lab, csl, Ep, 3a

- SECTION 4
TARGET NOTES
- 10 Lt, csn, Ea, Csl, RH, Lab, Rd, 3b, c/f
 - 11 Bedrock (csl, 3)



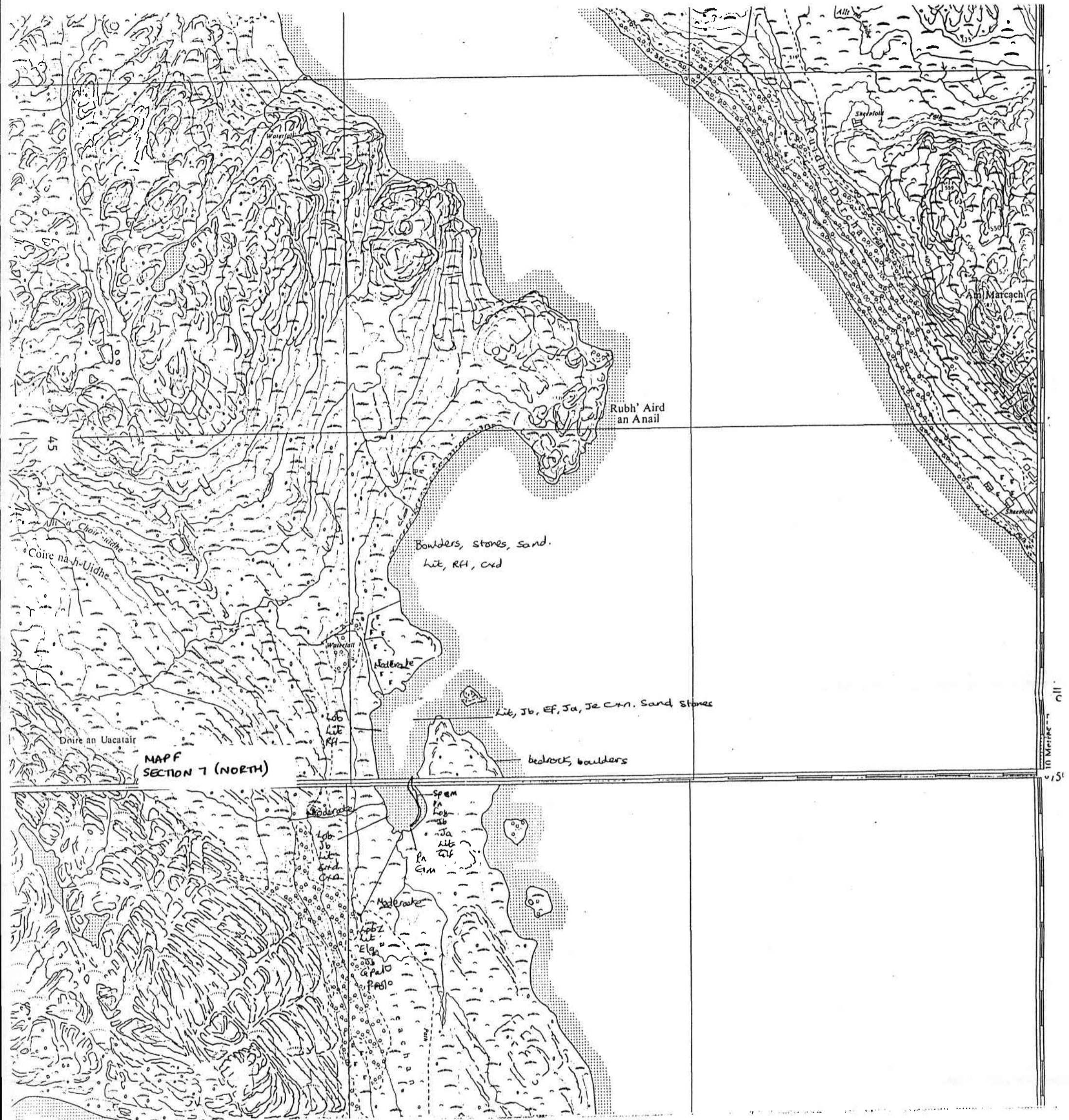


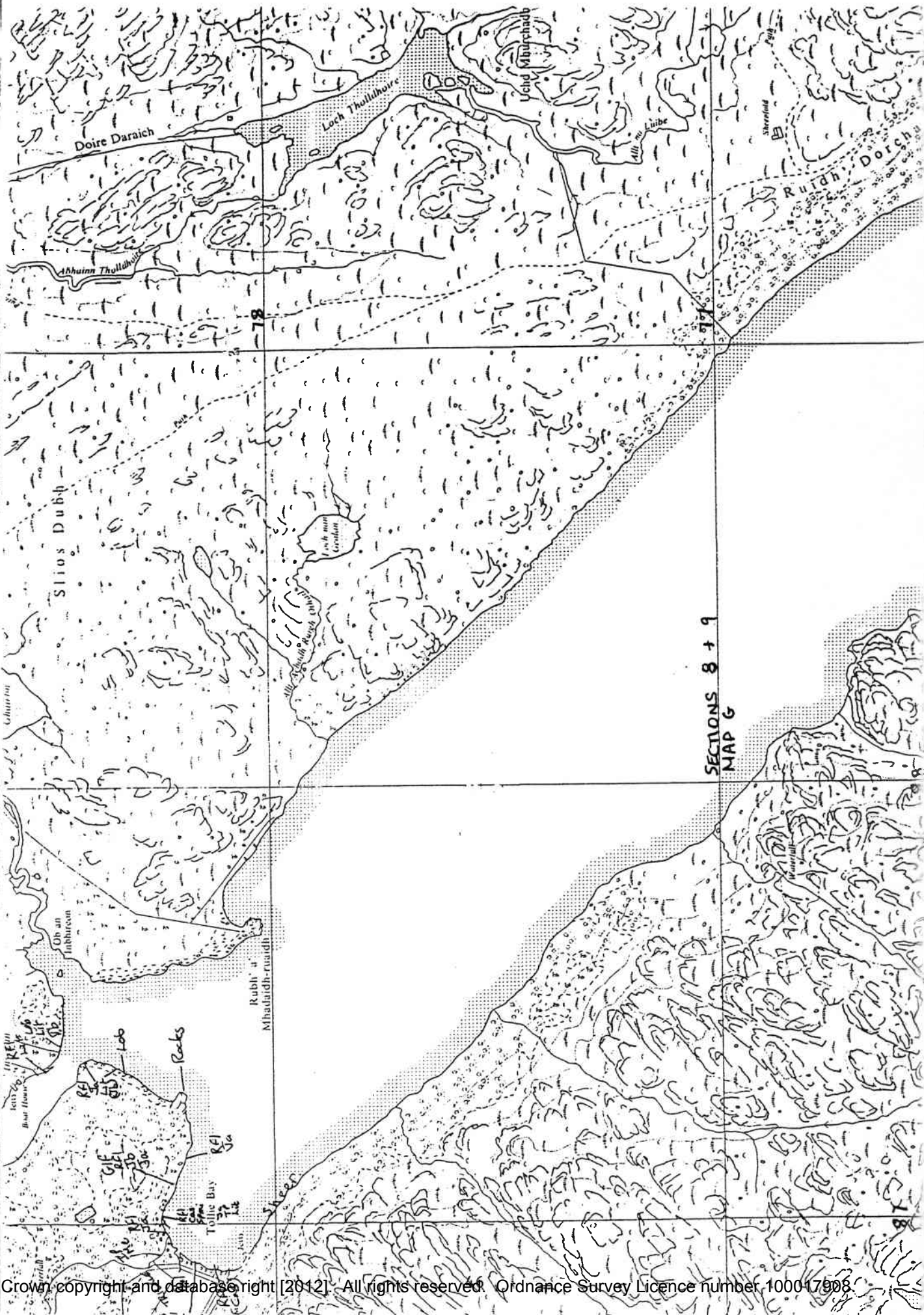
- Elq
- Lob, Rf1
- Pn
- Sand. Cxd, Ja, Lit. Boulders on shore
- Sand. Cxd, Ja, Lit, Rf1, Jb, Lob (Ep)
- Flush. Elq, Cxd, Lit, Rf1, Ja
- Lit, Rf1, Vp, Cxd, Ja
- Little Vegetation (Lit), Rf1
- Sròn na Ja, Cxd
- h-Uamhaig
- Ep, Cxd, Rf1, Vp, (Lit)
- Rf1, Lit
- Lit, Ja, Rf1, Gif, For, Cxd, can, Lit
- Stones
- Rf1, Ja, Lit, Cxd
- Ep, Lit, Rf1
- Trickle inflow Ja, can, Lit, Cxd, Rf1
- Trickle inflow. Epa (Cxd), Rf1, Lit, Lob, Ja, HU. Gravel
- LA, Rf1 Cxd (For)
- Lit, Rf1
- Boulders. Rf1 (Lit)
- Sand. Lit, Lob, Ja, Rf1, Cxd, (Age)
- Prol, Jb
- Slattadale car park. P.C
- Stones
- Gif, Rf1, Cxd, Lit
- Achillea ptarmica

G A I R L O C H

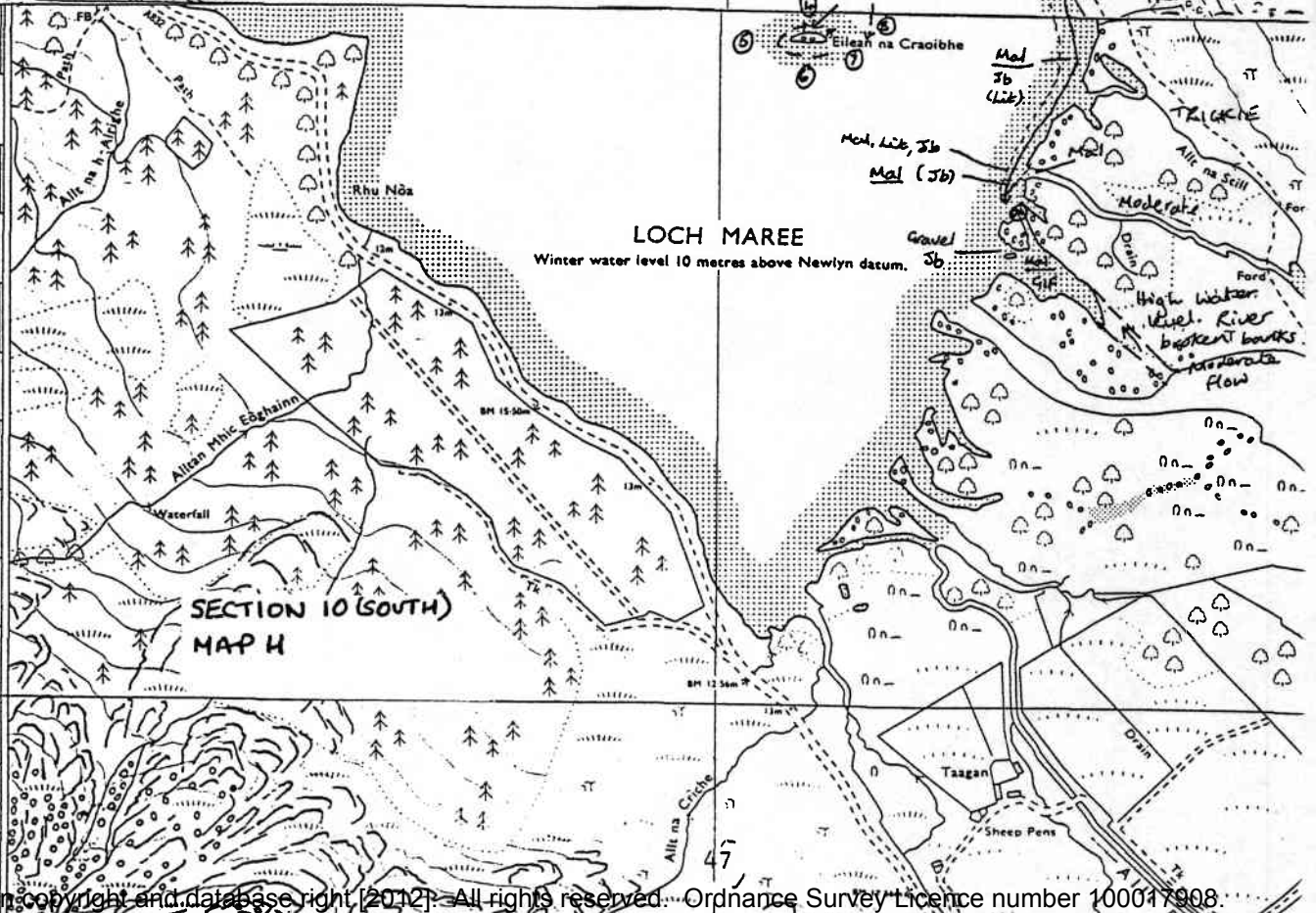
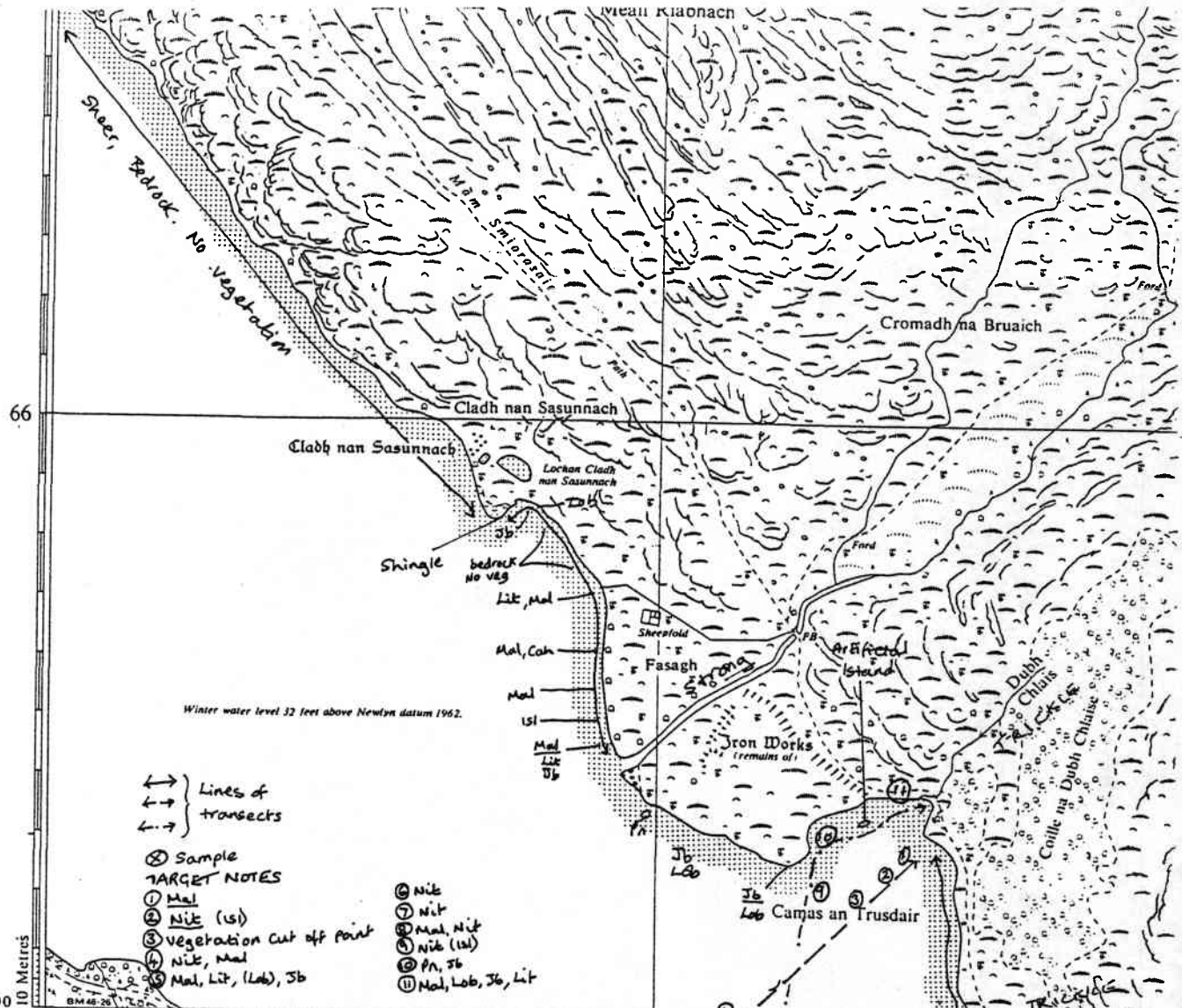
MAP E SECTION 7 (SOUTH)

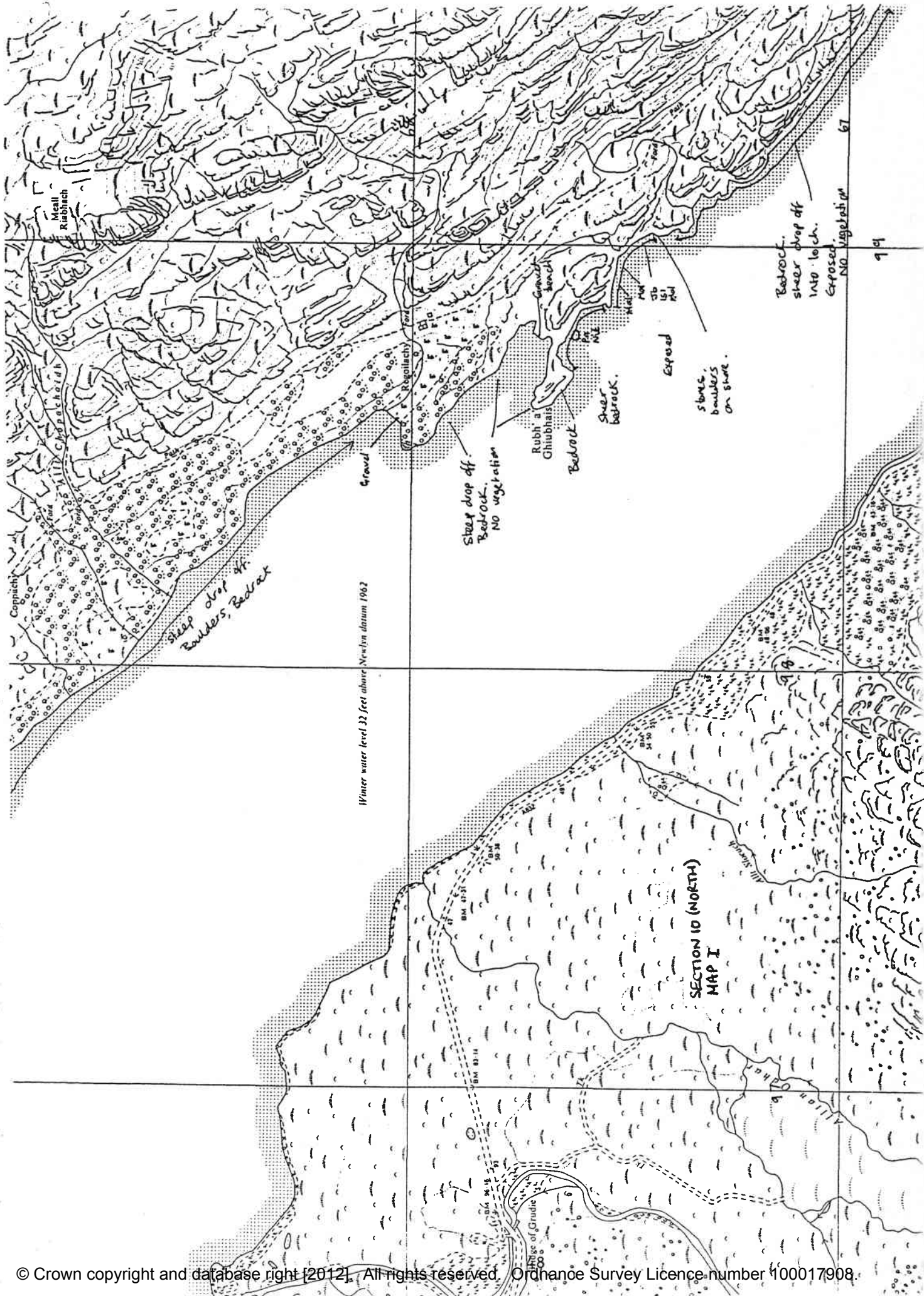
Winter water level 32 feet above Newlyn datum 1962.

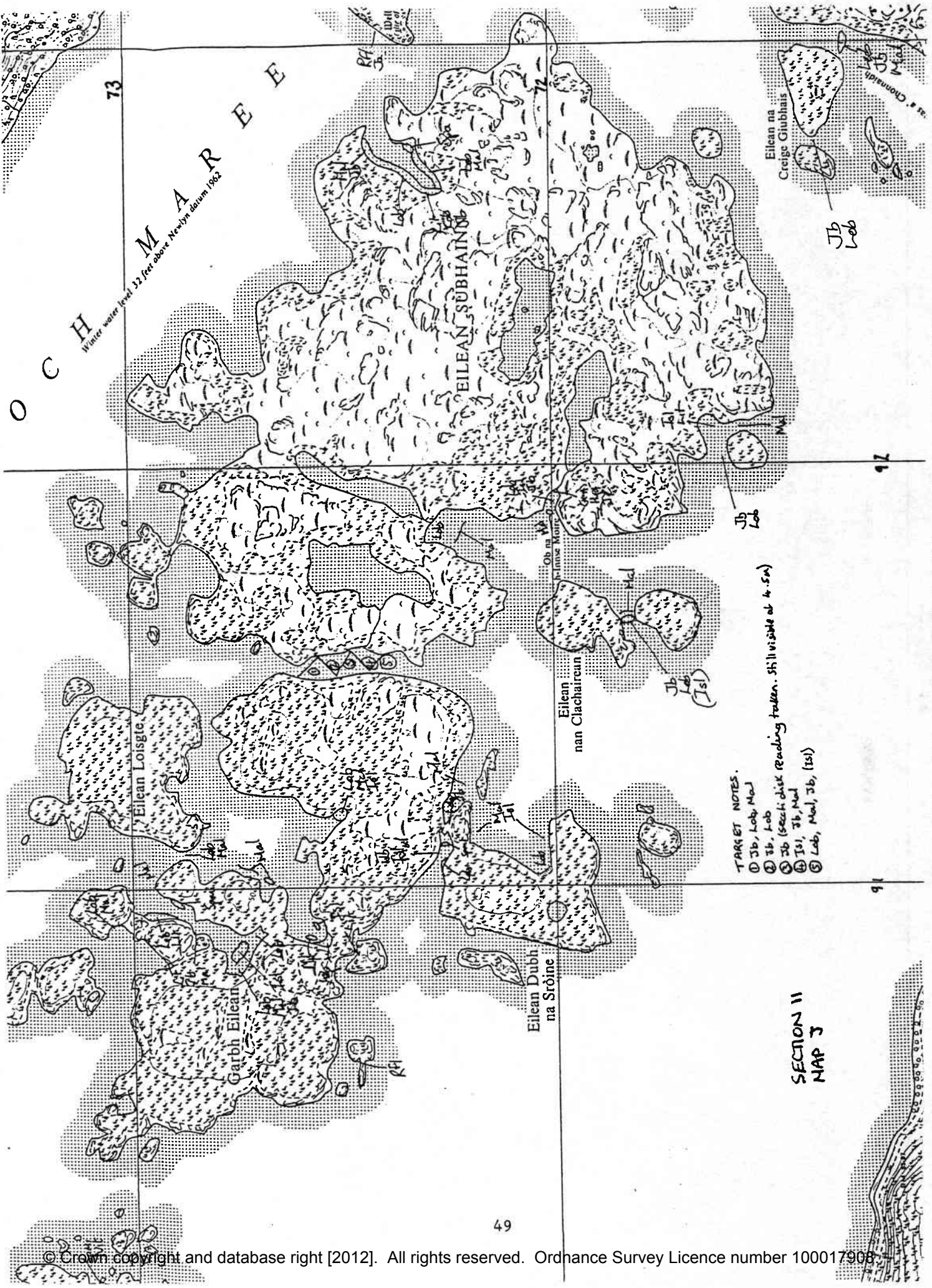




SECTIONS 8 + 9
MAP G







TARGET NOTES.
 ① Jb, Lob, Mal
 ② Jb, Lob
 ③ Jb (small disk Reading tracken. Still visible at 4.5m)
 ④ Jsl, Jb, Mal
 ⑤ Lob, Mal, Jb, (Jsl)

SECTION II
 MAP J

Rubha Chailleach

Suidhe Mhara

LOCH MAREE
Winter water level 3.2 feet above Newlyn datum 1962

Eilean Loisgte

EILEAN SÙBHAINN

Eilean nan Clachaircan

Ob na h-Innse Moire

Eilean na Creige Giubhais

Eilean Camas a' Chonnaidh

Camas a' Chonnaidh

LOCHAN A
TARGET NOTES

- ① Outflow stream is broad SF and Lob grow in the centre. Ela at edge
- ② Mal, Cas, Can, Uti, Jb, Sf
- ③ Pp, Sf, Jb, Lob, Lit, Na. Hydat edge
- ④ Jb, (Na), spa. Bedrock
- ⑤ Lob, Mal, Sf, Uti, Uti, Sphagnum sp.
- ⑥ Gif
- ⑦ Jb, Je, uti, Sc, Ja, Lit, Lob
- ⑧ Lob, Jb, Mal, Sf
- ⑨ Sf
- ⑩ Lob, Lit, Uti
- ⑪ Dse
- ⑫ Na, Elm
- ⑬ Pp, Sf
- ⑭ Lit, Lob, Dse
- ⑮ Dse, Rk, Ags, Myd, Lob, Lit, Sf.

LOCHAN A.
MAP K.

Stalla nam Manach

Rubha Chailleach

Suidhe Mares

LOCH MAREE
Winter water level 32 feet above Newlyn datum 1962

Eilean Loisgte

EILEAN SUBHAINN

Eilean nan Clachairean
Ob na h-Innse Moire

- LOCHAN B TARGET NOTES**
- ① Lob, lit, Isl, Jb, Jc, Elm
 - ② Elm, Lob, Lit
 - ③ Lob, Lit, Isl, Jb, Elm, Cam
 - ④ Lob, Lit, Jc, Elm, Silt
 - ⑤ Elm, Lob, Lit, Jc, Jb, Spmi
 - ⑥ Spmi
 - ⑦ Lob, Lit
 - ⑧ Spmi, Elm, Lob, Jb
 - ⑨ Prot, Elm, Jb, Gif, Na, Spmi, Lob, Lit
 - ⑩ Lit, Lob, Jb, Elm
 - ⑪ Elm, Spmi
 - ⑫ Lob, Jc, Elm
 - ⑬ Jc, Lit, Lob, Elm
 - ⑭ Gif, Lit, Lob, Elm

**LOCHAN B
MAP L**

Eilean na Creige Giubhais

Camas a' Chonnaidh

Eilean Camas a' Chonnaidh

Stalla nam Manach

Rubha Chailleach

Suidhe Mhree

LOCH MAREE
Winter water level 32 feet above Newlyn datum 1962

Eilean Loisgte

EILEAN SUBHAINN

Eilean nan Clachairean

Ob na h-Innse Mhoire

LOCHAN C
TARGET NOTES

- ① Na, Lob, Sf, Jb, Je
Sand, moderate infirm
- ② Spm, Sf, Ef, Uti, Na,
Elm, Is1, Is5
- ③ PpA, Rm, Na, Uti
- ④ Pn
- ⑤ Mt, Elm, Na, Je, Hyd, Cxd, Lob, Lyc
- ⑥ Pn, Mt, Na, Elm, Uti, Jb, Lyc
- ⑦ Na, Sf, Lob, Je, Is5
- ⑧ Na, Ef, Ja, Lob, Elm, Jb, Lyc
- ⑨ Je, Lob, Ef, Na, Jb
- ⑩ Glf, Jb, Sf, PpA, Uti
- ⑪ Cxro, Sf, Elm
- ⑫ Ef, Sf, Uti, Elm
- Na patches

LOCHAN C
MAP M

Eilean na Creige Giubhais

Eilean Camas a' Chonnaidh

Camas a' Chonnaidh

Staila nam Manach

Rubha Chailleach

Suidhe Mhara

LOCH MAREE
Winter water level 12 feet above Newlyn datum 1952

Eilean Loisgte

EILEAN SUBHAINN

Eilean nan Clachairean

Ob na h-Innse Moire

Eilean na Creige Giubhais

Eilean Camas a' Chonnaidh

Camas a' Chonnaidh

- LOCHAN D
TARGET NOTES
- ① OXRD, Sphagnum, Elm, PPR, SC
 - ② OXRD, Sphagnum, SF, Mt, Elm (ubm)
 - ③ Mt, Elm (Na, E/a), Sphagnum
 - ④ OXRD, Mt, PPR, Sphagnum
 - ⑤ Elm, E/a, Sphagnum
 - ⑥ OXRD, Elm, Mt, Sphagnum.

LOCHAN D
MAP N

Stalla nam Manach

Appendix III

Plant species recorded for species totals Loch Maree and island lochans.

SPECIES	LOCH MAREE	ISLAND LOCHANS			
		A	B	C	D EDGE
Edge species					
Agrostis stolonifera	/	/			
Caltha palustris	/				
Carex nigra	/	/	/		
Carex rostrata				/	/
Deschampsia setacea	/	/			
Eleocharis multicaulis	/	/	/		/
Eriophorum angustifolium	/				/
Glyceria fluitans	/	/	/		
Hydrocotyle vulgaris	/	/			
Juncus articulatus	/				
Juncus bulbosus	/				
Juncus conglomeratus	/	/	/		
Juncus effusus	/	/	/		
Littorella uniflora	/	/			
Lycopodiella inundata	/		/		
Mentha aquatica	/				
Menyanthes trifoliata	/		/		/
Potentilla palustris	/				
Ranunculus flammula	/	/			
Sparganium emersum	?				
Equisetum fluviatile	/		/		
Equisetum palustre	/				
Open water species					
Callitriche hamulata	/	/			
Callitriche stagnalis	/	/			
Elatine hexandra		/			
Juncus bulbosus					
var. fluitans	/	/	/		
Littorella uniflora	/	/	/		
Lobelia dortmanna	/	/	/		
Myriophyllum alterniflorum	/	/	/		
Nymphaea alba		/	/		/
Potamogeton natans	/	/	/		
Potamogeton polygonifolius	/	/	/		/
Scirpus fluitans	/	/	/		/
Sparganium angustifolium	/				
Sparganium minimum	/	/	/		
Subularia aquatica	/				
Utricularia intermedia *1	/	/	/		
Utricularia minor					/
Utricularia vulgaris		/			
Fontinalis antipyretica	/	/			
Isoetes echinospora			/		
Isoetes lacustris	/		/	/	
Isoetes hybrid?	/				
Nitella flexilis					
var. flexilis	/				

*1 Work by P. Taylor (pers. com.) has shown that additional species similar in structure to U. intermedia (including U. ochroleuca) also occur in Britain. Early work suggests that little U. intermedia actually occurs in Scotland. The specimens collected at Loch Maree were initially identified as U. intermedia, but are likely to be U. ochroleuca.

Additional plant species recorded Loch Maree and Island lochans

Species	Loch Maree	Island lochans			
		A	B	C	D
Carex demissa	/			/	
Carex echinata	/				
Carex panicea	/				
Eleocharis quinqueflora	/				
Galium palustre	/				
Viola palustris	/				
Equisetum sylvaticum	/				
Sphagnum sp.					/

Appendix II

Site name SECTION.7... Gr No. Mo

SUBMERGED AND FLOATING SPECIES

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR
Api*	Myosotis laxa	Pgr	Potamogeton graminus	Pgr	Potamogeton graminus
Ba *	Myosotis scorpiodes	Pn	Potamogeton natans	Pn	Potamogeton natans
Cah	Nasturtium officinale	Pxn	Potamogeton x nitens	Pxn	Potamogeton x nitens
Cher**	Oenanthe crocata	Pob *	Potamogeton obtusifolius	Pob *	Potamogeton obtusifolius
Cpla	Phalaris arundinaceae	Ppec*	Potamogeton pectinatus	Ppec*	Potamogeton pectinatus
Ca5	Phragmites australis	Pper	Potamogeton perfoliatus	Pper	Potamogeton perfoliatus
Ec	Potentilla palustris	Ppra**	Potamogeton praelangus	Ppra**	Potamogeton praelangus
Fon	Ranunculus flammula	PPol	Potamogeton polygonifolius	PPol	Potamogeton polygonifolius
Hip	Scirpus lacustris	Ppu *	Potamogeton pusillus	Ppu *	Potamogeton pusillus
Hyd	Scirpus tabernaemontanae	Pr **	Potamogeton rutilus	Pr **	Potamogeton rutilus
Iel	Sparganium erectum	Pxz	Potamogeton x zizzi	Pxz	Potamogeton x zizzi
Ias **	Sparganium emergum	Ra *	Ranunculus aquatilis	Ra *	Ranunculus aquatilis
Jb	Typha latifolia	RF..	Ranunculus peltatus	RF..	Ranunculus peltatus
Lm *	Veronica beccabunga	Rt *	Ranunculus trichophyllus	Rt *	Ranunculus trichophyllus
Lit	Veronica anagallis-aquatica	SA	Scirpus fluitans	SA	Scirpus fluitans
Lob	Veronica scutellata	Spa	Sparganium angustifolium	Spa	Sparganium angustifolium
Lur	Equisetum fluviale	Spai	Sparganium minimum	Spai	Sparganium minimum
Mal	Equisetum palustre	Sub **	Subularia aquatica	Sub **	Subularia aquatica
Map	Species total	Uti	Utricularia intermedia	Uti	Utricularia intermedia
Na	Other edge species	Um	Utricularia minor	Um	Utricularia minor
Nup **	Carex demissa	Uva	Utricularia vulgaris/australis	Uva	Utricularia vulgaris/australis
Pil **	Carex echinata	Une	Utricularia neglecta	Une	Utricularia neglecta
Pam	Carex panicea	Zan *	Zannichellia palustris	Zan *	Zannichellia palustris
Ph	Carex paniculata	Cha	Chara sp	Cha	Chara sp
Pal	Galium polustre	Nit	Nitella sp	Nit	Nitella sp
Pbe	Senecio aquaticus	Species total			
Pcr *	Triglochin palustris				
Pfr **	Viola palustris				
	Species requiring special protection within the HRPB area (Palmer & Newbold 1977)				

Site name Gr No

SUBMERGED AND FLOATING SPECIES

Map code	DAFOR	Map code	DAFOR
Api*	Apium inundatum	Pgr	Potamogeton graminus
Ba *	Baldellia ranunculoides	Pn	Potamogeton natans
Cah	Callitriche humulata	Pxn	Potamogeton x nitens
Cher**	Callitriche hermaphroditica	Pob *	Potamogeton obtusifolius
Cpla	Callitriche platycarpa	Ppec*	Potamogeton pectinatus
Ca5	Callitriche stagnalis	Q..	Potamogeton perfoliatus
Ec	Elodea canadensis	Ppra**	Potamogeton praelangus
Fon	Fontinalis antipyretica	Ppol	Potamogeton polygonifolius, Q..
Hip	Hippuris vulgaris	Ppu *	Potamogeton pusillus
Hyd	Hydrocotyle vulgaris	Pr **	Potamogeton rutilus
Isl	Isoetes lacustris	Ppz	Potamogeton x zizzi
Iss **	Isoetes (setacea) <u>lechnospora</u>	Ra *	Ranunculus aquatilis
Jb	Juncus bulbosus var fluitans	.O.	Ranunculus peltatus
Lm *	Lemna minor	Rt *	Ranunculus trichophyllus
Lit	Littorella uniflora	A. Sf	Scirpus fluitans
Lob	Lobelia dortmanna	.LF.	Sparganium angustifolium
Lur	Luronium natans	Spmi	Sparganium minimum LF..
Mal	Myriophyllum alterniflorum	Sub **	Subularia aquatica
Map	Myriophyllum spicatum	Uti	Utricularia intermedia
Na	Nymphaea alba	Um	Utricularia minor
Nup **	Nuphar pumila	Uva	Utricularia vulgaris/ australis
Pil **	Piluria globulifera	Une	Utricularia neglecta
Pam	Polygonum amphibium	Zan *	Zannichellia palustris
Ph	Polygonum hydropiper	Cha	Chara sp
Pal	Potamogeton alpinus	Nit	Nitella sp
Pbe	Potamogeton berchtoldii	Species total	
Pcr *	Potamogeton crispus		
Pfr **	Potamogeton friesii		
Pfi **	Potamogeton filliformis		

Site name Gr No

EMERGENT AND EDGE SPECIES:

Map code	DAFOR	Map code	DAFOR
Ag	Agrostis stolonifera	Myl	Myosotis laxa
Bu	Butomus umbellatus	Msc	Myosotis scorpioides
Cap	Calcha palustris	Nas	Nasturtium officinale
Cxa*	Carex aquatilis	Oc	Oenanthe crocata
Cxj	Carex lasiocarpa	Pa	Phalaris arundinaceae
Cxk	Carex limosa	Pha*	Phragmites australis
Cxp	Carex nigra	Pop	Potentilla palustris O..
Cxr	Carex rostrata	Rfl	Ranunculus flammula F..
Cxv	Carex vesicaria	Sl	Scirpus lacustris
Ela	Eleocharis multicaulis	St*	Scirpus tabernaemontanae
Eli	Eleocharis palustris	Sper	Sparganium erectum
Eri	Eriophorum angustifolium	Spem	Sparganium emersum
Gli	Glyceria fluitans	Tli*	Typha latifolia
Hip	Hippuris vulgaris	Vb	Veronica beccabunga
Hyl	Hydrocotyle vulgaris	Vaa*	Veronica anagallis-aquatica
Ipa	Iris pseudacorus	Vs	Veronica scutellata
Ja	Juncus articulatus	Ef	Equisetum fluviatile
Jb	Juncus bulbosus	Ep	Equisetum palustre
Jc	Juncus conglomeratus	Species total	
Je	Juncus effusus	Other edge species	
Li	Littorella uniflora	Cxd	Carex demissa
Lyl	Lycopodiella inundata	Cxe	Carex echinata F..
Lyx	Lythrum portula	Cxp	Carex panicea
Ma	Mentha aquatica	Cxpa	Carex paniculata
Mt	Menyanthes trifoliata	Sa	Senecio aquaticus
Mg	Mimulus guttatus	Tp	Triglochin palustris O..
Ml	Mimulus luteus	Vp	Viola palustris
Mon	Montia fontana		

Appendix II

Site name Gr No

Site name SECTION 10... Gr No

EMERGENT AND EDGE SPECIES:

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR
Ag	Agrostis stolonifera	.....	Myl	Myosotis laxa	.....	Api*	Apium inundatum	.....	Fgr	Potamogeton graminus	.....	DAFOR			
Bu	Butomus umbellatus	.....	Msc	Myosotis scorpiodes	.....	Ba *	Baldellia ranunculoides	.....	Pn	Potamogeton natans	.....	LA			
Ca	Caltha palustris	.....	Nas	Nasturtium officinale	.....	Cah	Callitriche hamulata	LF	Pxn	Potamogeton x nitens	.....			
Cxa**	Carex aquatilis	.....	Oc	Oenanthe crocata	.....	Cher**	Callitriche hermaphroditica	.....	Pob *	Potamogeton obtusifolius	.....			
Cxl	Carex lasiocarpa	.....	Pa	Phalaris arundinacea	.....	Cpla	Callitriche platycarpa	.....	Ppec*	Potamogeton pectinatus	.....			
Cxh	Carex limosa	.....	Pha*	Phragmites australis	.....	Ca5	Callitriche stagnalis	.....	Pper	Potamogeton perfoliatus	.....			
Cxn	Carex nigra	.....	Pop	Potentilla palustris	.....	Ec	Elodea canadensis	.....	Ppra**	Potamogeton praelangus	.....			
Cxp	Carex rostrata	.....	Rfl	Ranunculus flammula	.....	Fon	Fontinalis antipyretica	.....	Fpol	Potamogeton polygonifolius	.....			
Cxv	Carex vesicaria	.....	Sl	Scirpus lacustris	.....	Hip	Hippuris vulgaris	.....	Fpu *	Potamogeton pusillus	.....			
El	Eleocharis multicaulis	.....	St*	Scirpus tabernaemontanae	.....	Hyd	Hydrocotyle vulgaris	.....	Pr **	Potamogeton rutilus	.....			
Elp	Eleocharis palustris	.....	Sper	Sparganium erectum	.....	Isl	Isoetes lacustris	.....	Pxz	Potamogeton x zizzi	.....			
Ert	Eriophorum angustifolium	.....	Spem	Sparganium emersum	.....	Iss **	Isoetes (setacea) chinensis	.....	Ra *	Ranunculus aquatilis	.....			
Glf	Glyceria fluitans	.....	Tl*	Typha latifolia	.....	Jb	Juncus bulbosus var fluitans	DA	RP *	Ranunculus peltatus	.....			
Hip	Hippuris vulgaris	.....	Vb	Veronica beccabunga	.....	Lm *	Lemna minor	.....	Rt *	Ranunculus trichophyllus	.....			
Hy	Hydrocotyle vulgaris	.....	Vaa*	Veronica anagallis-aquatica	.....	Lit	Littorella uniflora	DAF	Sf	Scirpus fluitans	.....			
Ip	Iris pseudacorus	.....	Vs	Veronica scutellata	.....	Lob	Lobelia dortmanna	.....	Spa	Sparganium angustifolium	.....			
Ja	Juncus articulatus	LF	Vs	Veronica scutellata	.....	Lur	Luronium natans	.....	Spmi	Sparganium minimum	.....			
Jb	Juncus bulbosus	.....	Ef	Equisetum fluviatile	.....	Mal	Myriophyllum alterniflorum	LP	Sub **	Subularia aquatica	.....			
Jc	Juncus conglomeratus	.....	Ep	Equisetum palustre	.....	Msp	Myriophyllum spicatum	.....	Utl	Utricularia intermedia	.....			
Je	Juncus effusus	LF	Species total	Species total	.....	Na	Nymphaea alba	.....	Um	Utricularia minor	.....			
Lit	Littorella uniflora	.....	Other edge species	Other edge species	.....	Nup **	Nuphar pumila	.....	Uva	Utricularia vulgaris/australis	.....			
Lyc	Lycopodiella inundata	.....	Cxd	Carex demissa	.....	Pil **	Pilularia globulifera	.....	Une	Utricularia neglecta	.....			
Lyp	Lythrum portula	.....	Cxe	Carex echinata	.....	Pam	Polygonum amphibium	.....	Zan *	Zannichellia palustris	.....			
Ma	Mentha aquatica	.....	Cxp	Carex panicea	.....	Ph	Polygonum hydropiper	.....	Cha	Chara sp	.....			
Mt	Menyanthes trifoliata	.....	Cxpa	Carex paniculata	.....	Pal	Potamogeton alpinus	.....	Nit	Nitella sp	LP				
Mg	Mimulus guttatus	.....	Sa	Senecio aquaticus	.....	Pbe	Potamogeton bertholdii	.....	Species total	Species total	.....			
Ml	Mimulus luteus	.....	Tp	Triglochin palustris	.....	Pcr *	Potamogeton crispus	.....						
Mon	Montia fontana	.....	Vp	Viola palustris	.....	Pfr **	Potamogeton friesii	.....						
*	species requiring special protection within the HRPB area (Palmer & Newbold 1977)					Pfl **	Potamogeton filiformis	.....						
**	species occurring in less than 100 sq. m. in any 10 x 10 m. square in 1977														

Site name Gr No

Site name SECTION 11 Gr No
SEE MAP 3

EMERGENT AND EDGE SPECIES:

SUBMERGED AND FLOATING SPECIES

Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR	Map code	DAFOR
Ag	Agrostis stolonifera	Myl	Myosotis laxa	Api*	Apium inundatum	Pgr	Potamogeton graminus				
Bu	Butomus umbellatus	Msc	Myosotis scorpiodes	Ba *	Baldellia ranunculoides	Pn	Potamogeton natans				
Ca	Caitha palustris	Nas	Nasturtium officinale	Cah	Callitriche humulata	Pxn	Potamogeton x nitens				
Cxa	Carex aquatilis	Oc	Oenanthe crocata	Cher**	Callitriche hermaphroditica	Pob *	Potamogeton obtusifolius				
Cxl	Carex lasiocarpa	Pa	Phalaris arundinaceae	Cpla	Callitriche platycarpa	Ppec*	Potamogeton pectinatus				
Cxll	Carex limosa	Pha*	Phragmites australis	Ca5	Callitriche stagnalis	Pper	Potamogeton perfoliatus				
Cxnl	Carex nigra	Pop	Potentilla palustris	Ec	Eloides canadensis	Ppra**	Potamogeton praelangus				
Cxr	Carex rostrata	Rf1	Ranunculus flammula	Fon	Fontinalis antipyretica	Ppol	Potamogeton polygonifolius				
Cxv	Carex vesicaria	S1	Scirpus lacustris	Hip	Hippuris vulgaris	Ppu *	Potamogeton pusillus				
Elm	Eleocharis multicaulis	St*	Scirpus tabernaemontanae	Hyd	Hydrocotyle vulgaris	Pr **	Potamogeton rutilus				
Elg	Eleocharis palustris	Sper	Sparganium erectum	Isl	Isoetes lacustris	Pxz	Potamogeton x zizzi				
Erf	Eriophorum angustifolium	Spem	Sparganium emersum	Iss **	Isoetes (setacea) eckinospora	Ra *	Ranunculus aquatilis				
Glf	Glyceria fluitans	Tl*	Typha latifolia	Jb	Juncus bulbosus var fluitans	RA. RP *	Ranunculus peltatus				
Hlp	Hippuris vulgaris	Vb	Veronica beccabunga	Lm *	Lemna minor	Rt *	Ranunculus trichophyllus				
Hyd	Hydrocotyle vulgaris	Vaa*	Veronica anagalis-aquatica	Lit	Littorella uniflora	Sf	Scirpus fluitans				
Ip	Iris pseudacorus	Vs	Veronica scutellata	Lob	Lobelia dortmanna	SA. Spa	Sparganium angustifolium				
Ja	Juncus articulatus	Vs	Veronica scutellata	Lur	Luronium natans	Spmi	Sparganium minimum				
Jb	Juncus bulbosus	Ef	Equisetum fluviatile	Mal	Myriophyllum alterniflorum	Sub **	Subularia aquatica				
Jc	Juncus conglomeratus	Ep	Equisetum palustre	Msp	Myriophyllum spicatum	Uti	Utricularia intermedia				
Je	Juncus effusus	Species total	Species total	Na	Nymphaea alba	Um	Utricularia minor				
Lit	Littorella uniflora	Other edge species	Other edge species	Mup **	Nuphar pumila	Uva	Utricularia vulgaris/australis				
Lyc	Lycopodiella inundata	Cxd	Carex demissa	Pil **	Piluria globulifera	Une	Utricularia neglecta				
Lyp	Lythrum portula	Cxe	Carex echinata	Pam	Polygonum amphibium	Zan *	Zannichellia palustris				
Ma	Mentha aquatica	Cxp	Carex panicea	Ph	Polygonum hydropiper	Cha	Chara sp				
Mt	Menyanthes trifoliata	Cxpa	Carex paniculata	Pal	Potamogeton alpinus	Nit	Nitella sp				
Mg	Mimulus guttatus	Sa	Senecio aquaticus	Pbe	Potamogeton bertholdii	Species total	Species total				
Ml	Mimulus luteus	Tp	Triglochin palustris	Pcr *	Potamogeton crispus						
Mon	Montia fontana	Vp	Viola palustris	Pfr **	Potamogeton friesii						
	* species requiring special protection within the HRPB area (Palmer & Newbold 1977)			Pfij **	Potamogeton filiformis						
	** species occurring in less than 100 10 x 10 km squares in Great Britain.										