RAISED BOG RESTORATION PROJECT

AN INVESTIGATION INTO THE CONSERVATION AND RESTORATION OF SELECTED RAISED BOG SITES IN IRELAND

PART 2
SITE REPORTS (A4 Format)

A REPORT TO THE NATIONAL PARKS AND WILDLIFE SERVICE, DUBLIN.

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ADDERGOOLE, CO. GALWAY

1. SUMMARY OF SITE DETAILS

NHA No.	223	1/2" Sheet:	14
Grid Ref:	M 31 34	6" Sheet:	GY 69
GSI Aerial Photo:	M 277	1:25,000 Sheet:	11/23 SE
NHA Photo:	Film 256	Area (ha):	171.0 (High Bog)
Date(s) of Visit:	7-8/11/94 (Ecology) 7-8/11/94 (Geohydrology)		

Townlands: Addergoole, Lisheenanoran, Curraghmore and Barranny.

2. INTRODUCTION

2.1 BACKGROUND

Addergoole bog was visited by Douglas and Grogan in 1985. They describe a large wooded flush dominated by *Betula* with two open water bodies. The area to the SE of the flush is described as soft and wet although probably burnt in the past. *Narthecium* is abundant. To the N, towards the Cregg River, a transition from bog to fen is described. *Phragmites* is the dominant species here.

The site was considered to have a high conservation potential due to its location (one of the most westerly raised bogs remaining which are still relatively intact) and the presence of the large flush and fen area. It was therefore given an A rating and included in the list of possible NNRs (Cross, 1990).

A detailed vegetation study has also been undertaken by Bleasdale and Conaghan (1994). A number of releves on the high bog and flush are included in their report. They have also drawn up a vegetation map of the flush.

Mooney (1990) mapped the area of vegetation between Lough Corrib and the deep drains to the E of the high bog. See Section 6.1 for details.

2.2 LOCATION AND ACCESS

This bog is located on the eastern shores of Lough Corrib approximately 8km N of Galway city. The River Clare runs to the S and the Cregg River to the N. The Galway to Headford road runs by the E of the present extent of the site. It may be accessed from a bog road, to the E of the Galway to Headford road, which runs along the S of the bog.

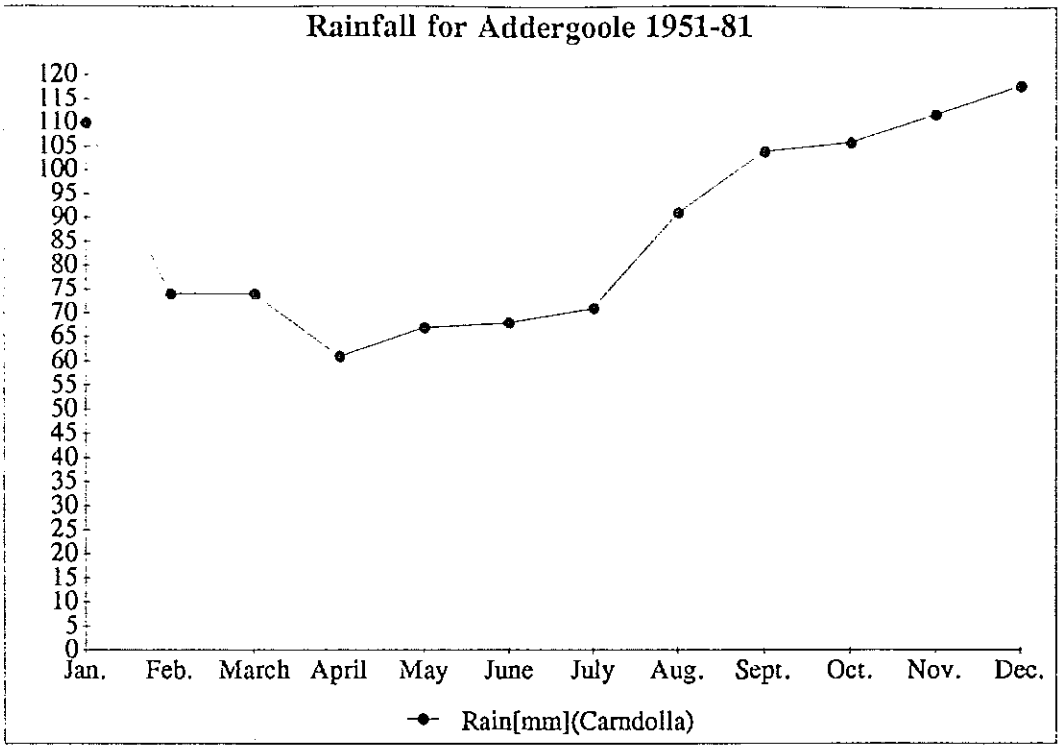
3. METEOROLOGY

No meteorological measurements have been made on Addergoole bog. Rainfall data from the nearby Carndolla rainfall station for the years 1951-80 indicate that the area receives an average 1056mm of precipitation annually (Fig. 1).

Potential evapotranspiration for this bog, taken from the met. office contour map, suggests that it is in the region of 500mm annually. However, the recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from a bog surface are significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, 1994).

The above factors suggest that the year round actual evapotranspiration (AE) from Addergoole bog is greater than PE. Annual evapotranspiration losses from the bog surface would therefore be greater than 500mm/yr.

Figure 1:



Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 556mm/yr.

Meteorological data for Addergoole Bog (1951-1981) are summarised below:

Rainfall (P)	1056mm/yr
Actual Evapotranspiration, (AE)	>500mm/yr
Potential recharge, (PR)	<556mm/yr

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

Addergoole is a large bog that originally had an expanse of over 7km. The present extent of the bog is 2km. It is confined to the east by the T 40 Headford-Galway road, to the N and S by the Cregg and Clare rivers, and to the W by Lough Corrib. It is very flat with gentle slopes to the north at the fen.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

Generally the topography of the surrounding area is flat, since it was once a former floodplain.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Drew and Daly (1994) show that the area is underlain by Pure Carboniferous limestones.

These pure limestones are karstified and are considered to be a regionally important aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

No subsoils data were available for Addergoole bog apart from the initial 1840s GSI geology field sheets, and recent fieldwork carried out for this study.

Geology of Inorganic Subsoils

The subsoil geology of this bog and surrounding area are dominated by clays deposited in a former lake. There was little information to be gained in recent fieldwork since exposures were minimal. Shell marl deposits are found in the N sections of the bog at the initiation of the fen zone.

5.1.3 Depth to Bedrock

Depth to rock on the bog is unknown.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology (See Drains and Hydrochemistry Map)

There are many old drains associated with active peat cutting around three sides of this bog and some of these have been extended on to the high bog since the time the 1970s aerial photograph was taken. There are also some old drains on the bog but these are not always well defined.

West

Drain bA to the WNW of the site is an extension of an older drain and is associated with active peat cutting. It is 1m deep by 1.5m wide, narrowing to 0.5m. There is water flow to the SW.

South East

Drain Complex bB is associated with Difco peat harvesting at the bog edge. There are 5 drains which are approximately 10m apart. They are up to 0.5m deep and wide. The two outer drains extend further into the site. There is rapid flow to the SE. The spoil is thrown up on either side of the drains. There is some collapsing along them and infilling with algae and *E. angustifolium*. There is tall *Calluna* along them (up to 40cm) and cracks at both sides of the drains. Between these two drains are three new, narrower drains 0.2m deep and wide with significant flow to the SE. There are also some cross drains between the two larger outer drains.

East

Drain bC is old and forms part of a townland boundary. It is aligned NNW/SSE. The NNW section cannot be seen in the field. The SSE section runs through Complex 6/4/10+Pools and there are pools right up beside it. The water table in the drain is very high at this point and where there is open water the drain is up to 1m deep and wide. In the open water sections it is colonised by unhealthy *S. cuspidatum*, *S. auriculatum* and *Menyanthes* with *S. papillosum* and *S. magellanicum* at the edges. The infilled sections are dominated by *Narthecium, Calluna, R. alba, Andromeda, E. angustifolium* and *S. papillosum*.

Drain bD is at a right angle with the SE end of Drain bC and is also old and forms part of a townland boundary. This drain is narrower. It is 0.5m wide with a high water table at the W end. It is infilling with *S. cuspidatum, S. auriculatum, Drosera* and *Menyanthes* with *S. papillosum* and *S. magellanicum* at the edges. *Narthecium* and *R. alba* were also recorded. There is a clump of *Myrica* near the junction with Drain bC. The E end of the drain is not well defined and consists of a band of *Calluna* up to 45cm tall.

Drain bE is old and aligned N/S running across a small lobe of bog near the E edge of the site. Old peat cutting has been carried out along it The drain is 1m wide widening at the N end. There are some collapsed sections and the drain is infilled with *Calluna, E. angustifolium, Narthecium* and *Cladonia*. There is a narrow channel along the edge of the drain with some infilling by *E. angustifolium, S. cuspidatum* and *S. auriculatum*. There is flow to the N.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map)

Water flowing from the bog and the adjacent inorganic subsoil was sampled on the 7-8/11/94. There had been several heavy rain spells over the previous three days.

South

Most of the drains mQ 3-7 have ECs of 270-360μS/cm.

South West

Drains mP have ECs in the range of 220-320μS/cm. *Schoenus* grows at the drains since they intercept the water-table.

North West

Drain mA has an electrical conductivity of 230μS/cm and intercepts the water-table. Drain mN has an EC of 400μS/cm. Drain mL has an EC of 214μS/cm but with high levels of iron. Drain mK has an EC of 550μS/cm. Drain mC has an EC of 362μS/cm.

East

Drains mB have ECs of 57μS/cm.

5.3.2 Laboratory Hydrochemistry

No samples were taken for analysis at the Coillte laboratory.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation

Addergoole bog lies alongside Lough Corrib and its easterly lake shore. The bog lies between two main rivers, the Clare and Cregg, and formed in a floodplain area since Lough Corrib may have been at a higher level than present.

Groundwater flow flows west under the bog discharging to Lough Corrib, the hydraulic low point for the region. The bog lies in a regional groundwater discharge zone.

Only a low proportion of rainfall is thought to recharge to groundwater in the region since there are high levels of runoff from the widespread clay tills. There are several streams and rivers in the area.

Bog Regime

There are many active drains in the cut-away discharging considerable amounts of water to the two rivers either side of the bog.

Both the eastern and southern parts of the bog have a high density of marginal drains due to extensive hopper cutting.

Inter-relationship

In the ESE, at the lake shore the regional groundwater-table would be at or near the surface. There is a large area of fen peat to the NW of the bog marking a natural groundwater discharge zone. ECs of ~400μS/cm in the drains indicate that regional groundwater is upwelling between the bog faces and the Cregg River forming the potential to create a lag zone. However, the drains have been deepened and a large grid drainage system has been set-up for land reclamation.

Generally ECs in the cut-away drains were in the region of 300μS/cm, indicating widespread groundwater discharge around the bog margins.

6. VEGETATION

6.1 VEGETATION SUMMARY

The main feature of this site is the large flush/soak which covers approximately 11ha. This is wooded mainly by *Betula* with abundant epiphytic lichens. The surface is very wet and *Juncus effusus* is quite common with a well developed *Sphagnum* layer. Two open water bodies are seen towards the E. A channel leads from the flush westwards into Lough Corrib.

A large area of vegetation surrounding the flush, particularly to the N and E, shows indications of enrichment and/or water movement. For example *Myrica* and *Empetrum* are quite common in Complexes 7/9+*Myrica*, 9/7+*Myrica* and 9A/10.

Two wet pool areas are seen on this bog. To the E of Flush Z Complex 6/4/10+Pools has approximately 20% *S. cuspidatum* pools and a high *Sphagnum* cover (50%). This covers about 10ha. Complex 6/9A+Pools to the S and NW of the Flush has *S. cuspidatum/S. auriculatum* pools and although the *Sphagnum* cover is low on the inter-pool areas the surface is quite soft. Complex 6/9A+Pools+*Myrica* to the SW of the flush has a very soft and quaking surface.

Overall the *Sphagnum* cover is low in the areas apart from the pool areas mentioned and around the flush.

Much of the S of the site has been recently burnt so that few well developed hummocks are seen but the *Sphagnum* cover is still quite high and shows signs of regenerating in places where it has been damaged.

Along the NNW edge the bog grades into fen vegetation dominated by *J. subnodulosus*, *Cladium*, *Phragmites* and *Molinia* with clumps of *Ulex*. *Phragmites*, *J. subnodulosus*, *Cladium* and *Schoenus* are seen on the bog as it grades into this area. It is difficult to say where the bog ends and the fen begins. Between this and the river further N new drains have been excavated since the time the 1970s aerial photograph was taken and some of the plots are grazed. To the NNE of the site the old cut-away is dominated by *Phragmites* with tall *Calluna* nearer the bog edge.

The vegetation of the cut-away which extends around three sides of this site is dictated by the type and intensity of peat cutting. To the ENE of the site the cut-away is extensive and there are recently re-excavated drains. The vegetation consists mainly of small amounts of *Phragmites*, *Molinia* and *Calluna*. South of this area the peat cutting is mainly by hand and there is a greater vegetation cover with abundant *Calluna*, *E. angustifolium*, some *Molinia* and large patches of *Phragmites*. Clumps of *Salix* and *Ulex* are also present.

Mooney (1990) mapped the area of vegetation between Lough Corrib and the deep drains to the E of the high bog. This area is shown to be dominated by the Community of *Sphagnum subnitens /Myrica gale* with patches of the Schoenetum nigricantis, the Caricetum elatae and the *Senecio aquaticus* community. At the lake edge the following are the most abundant: the *Phragmites australis/Carex lasiocarpa* community, the *Carex rostrata* community, the *Carex nigra* community and the Scirpetum lacustris.

To the S of the site where there is a combination of peat harvesting methods there are some large areas bare of vegetation which are associated with Difco and Hopper. Old peat cutting is colonised by *Molinia*, *Calluna* and *Pteridium* with *Salix* and *Pteridium* in the drains. *Phragmites*, *Typha*, *Juncus effusus*, *Myrica*, *Ranunculus flammula*, *Osmunda* and *Potamogeton polygonifolius* were also noted. Further W and closer to the lake there are old wet pits and some re-vegetation. There are indications that there are springs or up welling in the area as the EC in the pits and old drains ranges from 130 to 287 µS/cm and the vegetation is characteristic of mesotrophic conditions. Species in a drain (EC 134 µS/cm) include *Chara*, *Myriophyllum Sparganium minium*, *Potamogeton coloratus* and *Calliergon cuspidatum*.

Further into the bog the EC in a pit was 268 µS/cm and the following species were noted: *Schoenus nigricans, Carex lepidocarpa, C. rostrata, Cardamine, Equisetum fluviatile, Sparganium minium, Mentha, Menyanthes, Potamogeton coloratus, P. lucens, Juncus bulbosus, Phragmites, Scirpus lacustris, Parnassia palustris, Myrica, Typha, Chara, Hydrocotyle, Sphagnum squarosum, Scorpidium scorpiodies* and *Rhytidiadelphus squarrosus*. Beside the drains of this section of the cut-away the vegetation is dominated by *Molinia* and *J. effusus* with *Osmunda, Succisa, Agrostis, Pedicularis sylvatica, Polygala vulgaris, Hypochaeris radicata, Potentilla erecta, Calluna, Erica tetralix, E. angustifolium, Myrica, Schoenus, C. panicea, Aulacomnium, J. bulbosus* and *J. conglomeratus*. In the wetter areas *Calliergon cuspidatum* and *Rhytidiadelphus squarrosus* were recorded.

The vegetation along the W edge of the site is dominated by *Molinia* and *Phragmites* with *Cladium, Pedicularis sylvatica* and *Schoenus* with some *Calluna* in the vicinity of the old turf banks. Iron staining was recorded. Further N in the vicinity of active peat cutting the area is mainly bare of vegetation though there are clumps of *Ulex*. *Typha* and *Phragmites* were also recorded.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex I

This is seen as a narrow band at the edges where peat cutting has been carried out and especially along the drains. It is absent from the N of the site where it grades into fen. To the W of the site *Pteridium, Phragmites, Molinia, Rubus, Salix* and *Myrica* encroach along it.

Complex 2/6/9A

Close to the S side of the channel from Flush Z, vegetation dominated by *Trichophorum* (35%), *Narthecium* (30%), *E. angustifolium* (20%) and *Carex panicea* (15%) is seen.

Complex 9A/2/3

This complex is seen to the ESE of the site in association with active peat cutting and Slope 4 and is dominated by *E. angustifolium* 50%, *Trichophorum* 15% and *C. panicea* 15% with some *Narthecium, Calluna* and *Sphagnum*.

Complex 3/4

This complex is seen along part of the WSW edge of the site and the W edge N of Flush Z and is characterised by a dominance of *C. panicea* and *R. alba* with much surface water and damage from machinery - probably that involved with Difco cutting at the W end of Flush Z. There is almost no *Sphagnum* cover and little *Calluna*.

Complex 9A/3

This is seen in a small area close to the E of Flush Z. *E. angustifolium* and *Carex panicea* (20%) dominate. Some enrichment indicators are seen, such as *Juncus effusus* and *Vaccinium oxycoccus*. Some *S. cuspidatum* pools are also seen infilling with *S. magellanicum. S. papillosum* and *Aulacomnium* are seen at the edges. It grades in Complex 9/7. The complex is also seen at the SW of the bog close to the cut-away. *E. angustifolium* and *Carex panicea* dominate. The surface is very hard and slippy with a lot of surface water. It may be an old Difco peat cutting area. It is also seen to the mid WSW where it is similar.

Complex 6/3RB

This recently burnt complex dominated by *Narthecium* and *Carex panicea* is seen close to the S side of the channel leading from Flush Z. The *Sphagnum* cover is approximately 10% but is very patchy.

S. capillifolium and *S. imbricatum* are the commonest species. Some *S. cuspidatum, E. angustifolium* and algal pools are seen. Burnt degraded hummocks occur and burnt stems of *Myrica* are seen. The *Calluna* is very short (5-8cm) and patches of bare peat. Close to the flush channel the *Trichophorum* cover increases and the *Sphagnum* cover is also higher (20%). Another small area of this complex is seen to the SE of the site in association with Drain Complex bB with 40% *Narthecium*, 25% *C. panicea* and up to 25% bare peat. There are some tear pools present with *R. fusca*.

6/7 + *Myrica* + *Phragmites* (My + Ph)
This complex occurs towards the NW of the bog. *Narthecium* and *Calluna* dominate with scattered *Myrica*. *E. angustifolium* is also frequent. *Phragmites* occurs in an N/S band.

Complex 2/6/3 + *Myrica* (My)
This complex occurs towards the NW of the bog. *Trichophorum* (45%), *Narthecium* (15%), *Carex panicea* (10-15%) and *Calluna* (25%, 30-40cm tall) dominate. *Myrica* is scattered throughout. Patches of *Phragmites* occur increasing in frequency towards the northern bog edge.

Complex 9A/6/3
E. angustifolium, Narthecium and *Carex panicea* dominate. It is seen in a small area just to the NE of the E end of Flush Z. At the E end of the small bog lobe to the E this complex is seen with the addition of 10-20% *Cladonia portentosa* cover (Complex 9A/6/3 + *Cladonia*). The *C. portentosa* cover increases to approximately 40% towards the bog edge. The bog surface is hard in this area. The complex is also seen N of Drain Complex bB where the cover of *E. angustifolium* is up to 50%, *Narthecium* 20%, Carex *panicea* 10% and *Calluna* 15% at 30cm tall. There is scattered *Trichophorum* and *R. alba* throughout and the *Sphagnum* cover is poor consisting mainly of *S. capillifolium*. At the edge of this complex further into the bog there is a reduction in % cover of *E. angustifolium* and some small tear pools are present. The complex is also seen along the SW edge where there are clumps of bare peat with *Campylopus introflexus* and *R. alba*.

Complex 9A/6/3 + Tear Pools (TP) + *Myrica* (My)
This is seen close to the NE corner of the site in association with Slope 2. *E. angustifolium, Narthecium* and *Carex panicea* are frequent with *Myrica* cover at about 15-20%. The surface is very hard. There are some large tear pools with *E. angustifolium, R. fusca, Eleocharis multicaulis* and some *S. cuspidatum* (EC 77 µS/cm). *Narthecium* cover increases further west into the bog and the *Calluna* is quite tall.

Complex 9A/6
To the E of Drain complex bB there is an area of *Narthecium* and *E. angustifolium* dominated vegetation. The *Calluna* (25%) is up to 30cm tall. Occasional tear pools are seen with an E/W orientation. These are sometimes filled with *E. angustifolium*. The surface is not very soft. Low wide hummocks occur topped with *Calluna* and *Hypnum jutlandicum* mostly with some *Aulacomnium palustre*. Patches of *Cladonia portentosa* and *Myrica* are also seen. This complex also occurs on the lobe of bog to the E of the site. *Carex panicea* is present in noticeable amounts. The surface is very hard here too. Another patch of the complex is seen close to the NE edge where it is associated with active peat cutting and Slope 3 and there are erosion channels present. Tear pools are aligned E/W at the edge of the complex and N/S further into the bog. There are also patches of *E. vaginatum* up to 10% and *E. angustifolium, Calluna* and *Narthecium* at 20%. There is a moderate *Sphagnum* cover and the ground is not too hard. *Racomitrium* was seen.

Further N along the E edge patches of *Myrica* occur and at the very NE of the complex the% cover of *Calluna* increases to 60% and it is up to 50cm tall with a poor *Sphagnum* cover.

Complex 9A/6 + Tear Pools (TP)
This complex is similar to the above and is seen at the north side of the small bog lobe to the E of the site. The tear pools are aligned NW/SE and are partly inter connecting. They are mostly algal and probably developed due to slumping of the bog associated with peat cutting and drainage in the area.

Sub-Marginal Complexes

Complex 9A/6/2

This complex is seen to the E of Flush Z. *E. angustifolium* (40%), *Narthecium* (20%), *Calluna* (15%) and *Trichophorum* (10%) are the important elements. The surface is quite soft although the *Sphagnum* cover is low (10%). There is another area of this complex further north which is seen on part of the area which appeared as burnt on the 1970s aerial photograph. *E. angustifolium* and *E. vaginatum* make up 40% of the vegetation, *Calluna* 25% up to 30cm tall, *Trichophorum* 15% and *Narthecium* 20%. There is scattered *Myrica* in this area of the complex and little *Sphagnum* though the ground is soft. *Racomitrium* was seen.

Complex 6/9A/3 +*Myrica* (My)

Narthecium, E. angustifolium and *Carex panicea* dominate with patches of *E. vaginatum* and *Trichophorum*. It is seen to the NE of the site further into the high bog than Complex 9A/6/3 + Tear Pools (TP) +*Myrica* (My). *Myrica* is scattered throughout. The surface is a little soft with lots of surface water. Some E/W orientated tear pools are seen on the gentle slope to the N. Most of these are algal but some contain *S. cuspidatum*. It also occurs on the NW Lobe.

Complex 6/9A/3

This complex is also seen to the SW of the site where there is no *Myrica* and the *Cladonia portentosa* cover is up to 15% though the *Calluna* is short. The % cover of *Calluna* increases towards the N and W of the complex. *Pleurozia purpurea, S. fuscum* and *S. imbricatum* were seen. A circular mound of tall *Myrica* with *Molinia, Dryopteris, V. myrtillus, Rubus, Empetrum, Aulacomnium, Andromeda* and tall *Calluna* up to 80cm is seen within this complex. There are small pools filled with *S. auriculatum* and *S. cuspidatum* around the mound. *Cladium* occurs close by with *Molinia, Calluna, Andromeda, S. papillosum* and *S. capillifolium*. Close by, a large pool with *Cladium, Carex limosa, Potamogeton polygonifolius, S. auriculatum, Schoenus nigricans* and *Eleocharis* occurs (EC 79 µS/cm). Just beside this there is a line of *Schoenus* which may be part of a channel or tear. *Potamogeton polygonifolius* and *Menyanthes* also occur (EC 160 µS/cm).

Complex 6/9A

This complex is seen to the NW and N of Flush Z. *Narthecium* (35%), *E. angustifolium* (20%), *E. vaginatum* (20%) and *Calluna* (20%) dominate. The micro-topography is mostly uniform with some degraded hummocks. However no recent burn has occurred. *Calluna* ranges between 20 and 25cm in height and there are some patches of *Cladonia portentosa*. The total *Sphagnum* cover is approximately 10-15%, mostly *S. capillifolium*. The bog surface is not soft. Occasional algal hollows/pools occur. *E. vaginatum* cover drops to the E and NE.

Complex 6/9A+ *Myrica* (My)

This is similar to the above complex with the addition of *Myrica* and. It is seen to the N of Flush Z. Some pools occur which are quite large with *S. cuspidatum, Menyanthes, Drosera anglica, E. angustifolium* and *S. auriculatum*. *R. alba* is quite frequent. The *Sphagnum* cover increases southwards away from the bog edge to about 45%. It is mostly *S. papillosum* on the inter-pool areas with some *S. capillifolium* and *S. cuspidotum* and *S. auriculatum* in the pools. *Racomitrium* hummocks and *Pedicularis sylvatica* were noted. *Calluna* covers approximately 25% (30cm tall). Some hummocks are seen with *Aulacomnium palustre* and *Pleurozium schreberi*. *Myrica* and *Phragmites* is scattered throughout. The micro-topography is quite uniform apart from some large hummocks (0.5m high and 2m across) topped with *Empetrum, Dicranum, Hypnum jutlandicum, Leucobryum* and *Pleurozium schreberi*. Some hummocks are degraded with *Cladonia floerkeana* on them.

Towards the N of the site this complex also has patches of *Phragmites* (Complex 6/9A + Phrag). Bits of *Molinia* are seen too. *S. fuscum* was also noted. A winding line of *Schoenus nigricans* occurs within Complex 6/9A + Phrag. *Phragmites, Myrica* and tall *Calluna* also mark the line. It probably marks a concentration of water flow to the N, but there may also be some mineral influence (EC 77-102 µS/cm, recent very heavy rain).

Complex 6/9A + Tear Pools (TP)
This complex is similar to the above with the addition of tear pools. To the N of the wooded section of Flush Z the tear pools are quite large and are orientated SW/NE and NW/SE. These are infilled with *S. cuspidatum* and *E. angustifolium* though some are algal. *E. vaginatum* is quite frequent here.

Complex 6/9A RB (Recently Burnt) + Tear Pools (TP).
This is seen to the SE of the site close to the bog edge. The tear pools are quite large and inter connecting in places. They are mostly algal with some *E. angustifolium*. The micro-topography between the pools is otherwise quite uniform. The *Calluna* is very short (10cm at most). The remains of burnt out hummocks can also be seen. *Sphagnum* cover is low (5%) but appears to regenerating. *S. capillifolium* and *S. papillosum* are the most frequent species with some *S. tenellum and* small amounts of *S. imbricatum* and *S. magellanicum* also. Bare peat covers about 15%. *Carex panicea* is also present (5-10%) increasing towards the edges and *Pedicularis sylvatica* occurs frequently. The surface is mostly hard but some *Narthecium* (up to 45%) flats are a little soft. There are some isolated clumps of low growing *Myrica* throughout.

Sub-Central Complexes
Complex 6/9A + Pools + *Myrica* (+P+*My*)
This complex is seen to the SW of Flush Z where the area is soft and quaking. The pools are large and some inter-connect. They are infilling with *S. cuspidatum, S. auriculatum, R. alba, E. angustifolium, Drosera* and *Menyanthes. Schoenus* is present. There are low wide hummocks between some of the pool areas dominated by *Calluna* up to 30cm tall, 10% *Cladonia, E. vaginatum, Narthecium, Myrica, S. capillifolium, S. papillosum, S. fuscum, S. imbricatum* and abundant *Hypnum*. Next to the SW edge of Flush Z part of this complex has been burnt and has bare peat, degraded hummocks, no *Cladonia, Calluna* up to 15cm and pools still present.

Complex 6/9A+ Pools (P)
This complex is seen directly S and to the NW of the flush. *Narthecium* (45%) and *E. angustifolium* dominate (25%). *R. alba, Trichophorum* (up to 10%) and *E vaginatum* (10%) are also present but in small amounts. The pools are linear and infilled by *S. cuspidatum* with *E. angustifolium, Menyanthes* and some large *Racomitrium* islands. *S. auriculatum* occurs in some pools with *S. papillosum* and occasionally *S. magellanicum* at the pool edges. The *Sphagnum* cover is quite low on the inter-pool areas. The bog surface is a little soft but not very in the inter-pool areas. The *Calluna* is generally short around 10cm but some up to 20cm. Patches of *Cladonia uncialis* and *C. portentosa* occur. To the NW of Flush Z the pools are quite small and have a NE/SW orientation and some are algal. *Drosera anglica* was also noted in the pools. *S imbricatum* was recorded in this area. To the SW the *Calluna* is about 30cm tall. The pools are linear. The area has the appearance of being burnt in the past but not very recently. The *Sphagnum* cover here is about 30% including the aquatic species. Towards the N of the site this complex also has patches of *Phragmites*.

Complex 6/9A RB+Pools
At the SE of the bog there is an area of this complex which has been recently burnt. Parts of the complex with some pools have escaped the most recent burning. Bare peat accounts for approximately 10%. Occasional dried out algal hollows occur. A little water is seen in some. Water table fluctuations must be high in this area. Between Drain Complex bB parts of this vegetation has not been burnt but the pools are all dried out due to the effect of the drains.

There is a recently burnt area of this complex 6/9A+ Pools RB to the S and E of Flush Z. It is very similar to the above complex except that the *Calluna* is very short (5-10cm) and *Carex panicea* is more frequent (5-10%). Pools occur at between 15-20% and the cover of R. alba is approximately 5-10%. There is a general E/W orientation to the pools but some are rounded. *Campylopus atrovirens* is seen around some pool edges. The total *Sphagnum* is appropriately 40% with *S. magellanicum* and *S. imbricatum* frequent. *S. fuscum, Pedicularis sylvatica* and *Pleurozia purpurea* were also noted.

Complex 4/9A/6 + Pools (P) and 4/9A/6 + Tear Pools (TP)
This is seen to the E of the site in the vicinity of Drain bC. It is dominated by *R. alba* (25%), *E. angustifolium* (25%) and *Narthecium* 20% with 20% *Calluna* which is up to 20cm tall. The *R. alba* and *Narthecium* dominate the flats or lawns. There are some small pools 10-15% some algal and some with *S. cuspidatum, S. auriculatum, R. alba, Menyanthes, Drosera* and *E. angustifolium* with *S. papillosum* and *S. magellanicum* at the edges. The overall *Sphagnum* cover is 20-25% and the surface is soft. Small amounts of *S. imbricatum, S. fuscum* and *S. subnitens* were recorded. Some low wide hummocks with *Calluna, Empetrum, V. oxycoccus, Pleurozium schreberi, Aulacomnium* and *S. capillifolium* occur throughout the complex.

The pools (up to 30%) get larger (up to 8m) towards the E of the complex and the *S. cuspidatum* is more un-healthy. Methane gas was seen bubbling up in the pools. The pools inter-connect better at this end. There is abundant *R. alba* and some *Trichophorum* in the area. There is a slight slope to the SE at this edge of the complex and this may be associated with the active peat cutting. There is a very small amount of *Cladonia* in the complex and *Racomitrium, Campylopus atrovirens* and *Pleurozia purpurea* were seen.

Complex 6/4/10+ Pools
This occurs in a central area to the E of the bog. *Narthecium* (40%) and *R. alba* (20%) dominate with abundant *E. angustifolium*. The total *Sphagnum* cover is high (50%) and the surface is very wet and soft. Pools account for about 20%. They are small and more or less linear with *S. auriculatum, S. cuspidatum, Menyanthes, R. alba* and *E. angustifolium*. Infilling pools with *S. magellanicum* at the edges are seen. Some pools are algal. *Aulacomnium palustre* is frequent. *Cladonia portentosa* and *C. uncialis* cover accounts for approximately 5%. *Empetrum, Pleurozium schreberi* and *Polytrichum alpestre* are seen on some hummocks. This whole area is very flat.

Complex 7/9+ *Myrica* (My)
This occurs to the SE of Flush Z. *Calluna* (80%, 40-60cm high) and *E. vaginatum* (15%) dominate with *Myrica* (5%). It forms part of a winding channel which leads into Flush Z. The bryophyte cover is similar to Complex 9/7 with some *Hylocomium splendens*. Small patches of *Molinia, Juncus effusus, Osmunda* and *Dryopteris dilatata* occur. A small area of this complex is seen to the N of the exit channel of Flush Z with the addition of some *Phragmites* (7/9+My+Ph).

Complex 9/7 + Myrica (My)
This is seen in a large band running N/S to the E of Flush Z. *E. vaginatum* (50-70%) and *Calluna* (30% and 45-50cm tall) dominate. Enrichment indicators such as *Empetrum, Vaccinium oxycoccus, Aulacomnium palustre* and *Pleurozium schreberi* are frequent. *Myrica* also occurs in patches (with epiphytic lichens) suggesting lateral water flow. *Andromeda* quite frequently seen. The bryophyte cover is high (90%), mostly *S. capillifolium* and *S. imbricatum*. The bog surface is very soft, squelching and difficult to walk through. Large patches of *Cladonia portentosa* were noted. Some *S. cuspidatum* pools are seen within the complex and also *S. papillosum* and *S. magellanicum* lawns with *Menyanthes*. Some *Betula* with abundant epiphytic lichens are also seen (< 1m tall).

There is a slightly darker area to the NW where the *Calluna* is a little taller and the *Myrica* is up to 70cm high. *Vaccinium oxycoccus* is abundant in this area. This area may form a pattern which leads into the flush.

Closer to Flush Z *Osmunda, Potentilla erecta* and *Dactylorhiza maculata* were seen in this complex.

A section of this complex has been recently burnt, directly to the E of Flush Z (Complex 9/7 RB). Burnt stems of *Calluna* (*Calluna* re-growth 10cm) and *Myrica* are obvious. The *Sphagnum* cover is high (80%), mostly *S. papillosum* and *S. magellanicum* and there is a lot of surface water. *E. angustifolium* is also frequent.

Complex 9A/10
This is seen to the NE of Flush Z. *E. angustifolium* dominates (30%) with *E. vaginatum* (5%) and some *Narthecium*. The *Sphagnum* cover is very high 80%, mostly *S. papillosum* and *S. capillifolium*. Some *Aulacomnium palustre* is also present. *Menyanthes* grows up through the lawns. It is under the influence of the flush as some enrichment features are seen such as *Empetrum*. The bog surface is very soft here.

6.2.2 Flushes
Flush Z is a large flush/soak which covers approximately 8 ha of this bog. It is *Molinia* dominated with a *Betula* woodland to the northern end and some small lakes in the eastern section. There is a spring area at the extreme eastern end. The wet area drains to the WNW towards Lough Corrib. This flush exit is seen as a band of *Molinia, J. effusus, Myrica* and *Pteridium*.
The wooded section of the flush (PM 19: 13+14) is dominated by *Betula* which are up to 2.5m tall at the edges rising to greater than 4m in the centre. There is abundant epiphytic lichen cover on them (5/5), mainly *Usnea* and *Parmelia* species. Other species surrounding the trees include *Calluna* and *Myrica* up to 1m tall, *Molinia, J. effusus, V. oxycoccus, Dryopteris, E. vaginatum, Andromeda* and *Empetrum*. There is almost 100% bryophyte cover consisting of *S. papillosum, S. cuspidatum, S. capillifolium, S. recurvum, Hypnum, Aulacomnium palustre* and *Hylocomium splendens* and the ground is soft and very wet with a high water table. Species seen under the trees include *S. papillosum, S. palustre, Polytrichum commune, Pleurozia schreberi, Osmunda, Dryopteris* and *E. tetralix* with the following seen in a clearing: *C. rostrata, S. capillifolium, S. squarrosum, Cephalozia bicuspidata* and *S. palustre*.

The more north easterly of the small lakes (PM 19: 16-18) has an EC of 63 µS/cm. It is the smaller of the lakes and more shallow. There is some open water but much of the lake is infilled with *Sphagnum* lawns - mainly *S. cuspidatum* with *S. recurvum* and *S. auriculatum*. Growing through the lawns are *Molinia* tussocks, *Menyanthes, J. effusus, C. limosa, C. rostrata, J. squarrosus, J. bulbosus* and *E. angustifolium*. At the edge of the lake a wide range of species were recorded - *Calluna, Myrica, Osmunda, V. oxycoccus, Andromeda, Empetrum, Hydrocotyle, Rumex, Aulaconnium* and *Dicranum*.

Between the lakes is a band of *Molinia* dominated vegetation with some *Sphagnum* pools/lawns. A clump of *Typha* was also recorded.

The more south westerly lake is quite deep with a large body of open water (EC 70 µS/cm). The species list is similar to the more easterly lake though the vegetation structure is different. There is very little infilling with *Sphagnum* lawns. *Peltigera membranacea* was recorded. At the SE end of this lake there is a smaller lake (EC 69-73 µS/cm) with *S. lacustris,* abundant *C. limosa* and *C. rostrata* and *Potamogeton coloratus*.

West of the wooden soak section and nearing the flush exit, the vegetation is dominated by *Pteridium with some Myrica*. There is a ground cover layer of 90% *S. capillifolium* and *S. papillosum* with *Polytrichum commune* and *Cephalozia bicuspidata*. The ground is soft and quite wet.

The exit of the flush to the W has tall *Calluna* (with epiphytic lichens), *Pteridium* and *Rubus* along the edges. Very tussocky *E. vaginatum* growth with *Myrica* (some burnt stems on the southern side) is seen just beside the channel. The centre of the channel is dominated by *Juncus effusus* and *E. vaginatum* with abundant *Dryopteris dilatata, Myrica* and *Calluna*. Other species noted were *Galium palustre, Rumex, Potentilla erecta, Rubus, Vaccinium oxycoccus, Andromeda, Carex limosa, Agrostis, Menyanthes, Salix* (many lichen epiphytes), *Betula* and *Pteridium. S. papillosum* dominates the bryophyte layer with *Polytrichum commune, Aulacomnium palustre, Eurhynchium praelongum, S. capillifolium, S. squarrosum, S. palustre, S. cuspidatum, S. recurvum* and *Rhytidiadelphus squarrosus*. The bog surface was very wet in parts of this channel and open water was present in parts (EC 90 µS/cm). A line of *Calluna* (30-40cm tall) branches off from the channel to the NW and the cut-away area to the W. *Phragmites* is seen between this branch and the flush channel. *E. vaginatum, Narthecium* and *Myrica* are also present in notable amounts.

At the NW of the flush near the exit there is some active peat cutting - Difco - and new narrow drains with significant flow NNW into a deep and wide irrigation channel. This disturbed section of the flush is dominated by *J. effusus* and *J. conglomeratus* with *Myrica, Osmunda, J. bulbosus, Pteridium, Agrostis, Rumex, Succisa, Dryopteris* and burnt *Salix*. Parts of this end of the flush appear to have been burnt during the past 3-5 years.

The vegetation of this flush was examined in greater detail by Conaghan and Bleasdale (1994). They recorded the vegetation in a number of releves and divided the vegetation of the flush into five regions which they mapped. The five divisions were :
1 The *Betula pubescens/Sphagnum palustre* community
2. The *Calluna vulgaris* and *Aulacomnium palustre* community
3. The *Menyanthes trifoliata* and *S. cuspidatum/S. recurvum* community
4. The *Juncus effusus/Sphagnum* community.
5. Mixtures of 2 and 3.
The species list for the flush compiled by Conaghan and Bleasdale (1994) is more comprehensive than that recorded during this survey.

Two water samples were taken from this flush in June 1993 for hydrochemical analysis (Kelly, 1993). The following results were obtained:

	pH	EC	Na	K	Fe	Mn	Ca	Mg
Betula woodland	3.62	81.4	10.3	0.08	0.04	0.02	0.55	0.89
Open water pool	3.73	67.6	8.8	1.13	0.08	0.01	0.52	0.74

These indicate no ground water input into the flush as levels are typical for ombrotrophic bog water. However to the SE of the lakes within the flush and aligned SE/NW is a narrow linear band of *Myrica, Schoenus, Succisa, Molinia, Cardamine, J. effusus, Salix, Potamogeton coloratus, C. lepidocarpa, Dryopteris, Rubus, Andromeda,* young *Betula* and *Polytrichum commune.* The EC was measured along this band from NW to SE. The following EC measurements were recorded: 68-87-113-96-76 µS/cm. Some ground water input is indicated here.

Fen Area
To the N of this site a transition from bog to fen is seen towards the Cregg River. This was not examined in detail during this survey. On the northern high bog edge *Phragmites* is common extending quite far into the site. *Molinia* and *Myrica* are also seen. Lines of *Cladium* and *Schoenus* occur with other species such as *Potentilla erecta, Pedicularis sylvatica, Myrica* and *E. vaginatum* occur (EC 77-102 µS/cm). There is a small step down from the high bog into the fen area. This area was very wet in parts at the time of the survey. *Molinia* and *Phragmites* dominate with *Juncus subnodulosus* and *Cladium. E. angustifolium, Menyanthes, Carex rostrata, Sphagnum subnitens, S. auriculatum* and *S. cuspidatum* occur (EC 74 µS/cm). Small amounts of *Calluna* are seen also. Towards the river some patches of *Ulex* were noted. These are visible on the aerial photograph.

7. BOG TYPE

This bog has been classified as a Broad Floodplain bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes (Map)

Overall this bog is quite flat. There is a general tendency to slope gently WNW towards Lough Corrib at the W edge of the bog. The direction of flow from a flush area at the SW of the site is similar. There is also a gentle slope NNW towards the Cregg River. Flush Z is located in a slight depression. A number of slopes were estimated in the field. These are described below and shown on the Slopes Map.

Slope 1 At the SW of the bog the slope to the SW towards Lough Corrib is 0.5 m over 75 m.

Slope 2 The slope to the NNW parallel to Drain bF at the NE of the site is 0.75 m over 50 m.

Slope 3 This slope along the NE edge of the site is 0.75m over 50m to an area of active peat cutting. The hopper method is used and the facebanks are up to 1m tall.

Slope 4 This slope at the SE of the site is 0.5m over 50m into an area of actively harvested peat. Difco method is used.

Slope 5 This slope at the SE of the site is 0.75m over 150m to an area of old peat cutting dominated by *Phragmites*. The facebanks are up to 1m tall.

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

There are roads/tracks around two sides of this site and extensive peat cutting has been carried out in the past around three sides. Deep drains and the presence of the River Cregg at the NNW edge prevents access. In the past the peat cutting was by hand and there are many shallow old turf banks and old infilling drains some up to 3m wide as evidence of this - S and W. Active peat cutting is also carried out particularly to the E of the site and there are long deep drains in the cut-away associated with this. There are very few new drains on the high bog which are associated with active peat cutting - Drain bA to the NW of the site and Drain Complex bB to the SSE. Some of the old drains present on the 1970s aerial photograph have been extended especially along the S edge. Today mainly the Hopper method of extraction is used in some of the older cut-away particularly to the E of the site and deep new drains have been re-excavated in this area. Hand cutting is still also carried out around the site. Facebank height around the site varies. It is shallow at the SW edge where most of the peat cutting is old or hand harvested at present (< 1m); N of the flush exit there is Difco and hand cutting and the facebanks are up to 1.5m tall; at the NW edge there is evidence that there was some peat cutting in the very distant past and the facebanks are up to 0.5m or absent; to the NNE of the site in the area where the peat cutting is mainly by Hopper the facebanks are quite shallow as the peat cutting is confined to the old cut-away. Here the drains are up to 3m deep and some are very wide - up to 5m and at the ESE, where the peat is harvested mainly by hand, they are up to 1m. Difco peat cutting is presently carried out in some locations on the high bog:- to the W the near the exit of Flush Z and NW of it; at the ESE and at the SSE in the vicinity of Drain bB. Difco is also carried out in the old cut-away to the S of the site.

8.2.2 Fire History

Fire has probably been a recent occurrence at this site considering the amount of peat cutting. Few tall hummocks and a lack of Cladonia portentosa cover over a majority of the site indicates a fire history. Complex 9/7 to the NE of Flush Z and the main body of the flush itself have escaped recent burning. To the S and SE of the site recent burning was noted. This extended into part of Flush Z. According to Conaghan and Bleasdale *(Pers. comm.)* this area was burnt in 1993.

8.2.4 Dumping

Dumping of household refuse and old cars is seen on the cut-away areas to the S of the site along the access road.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. The large flush at this site is associated with an internal drainage pattern and it occurs in a slightly depressed area. Complex 9/7+ *Myrica* is an area of enriched vegetation which is associated with the flush.

2. In places over the site where *Schoenus nigricans* occurs the peat layer is probably quite thin and local ground water discharge is occurring.

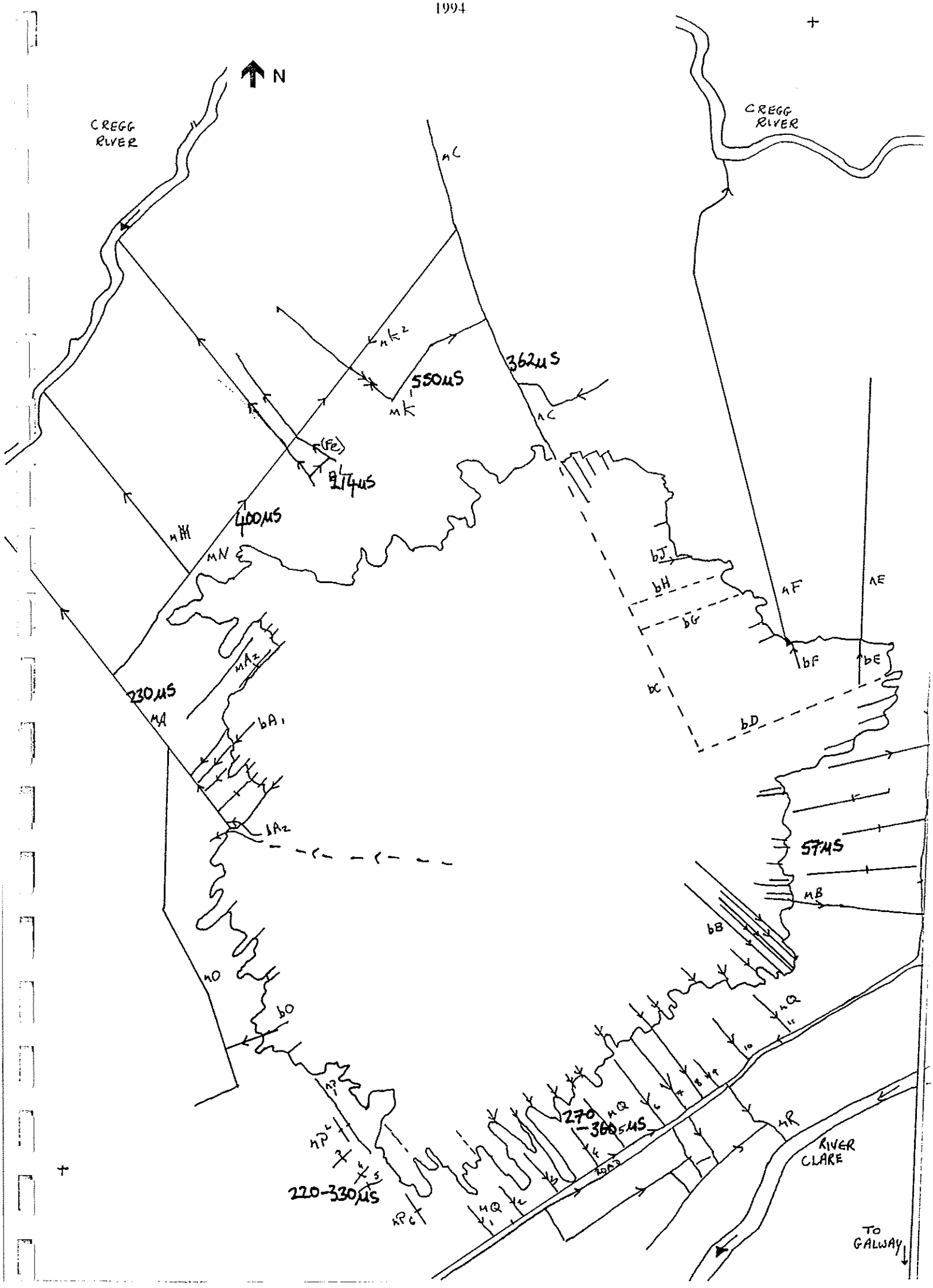
3. The fen and lake side vegetation occur due to ground water inputs.

4. This site is quite flat so large areas of central vegetation would be expected. However the present site is only a remnant of a much larger original site and drainage effects due to peat cutting have been severe.

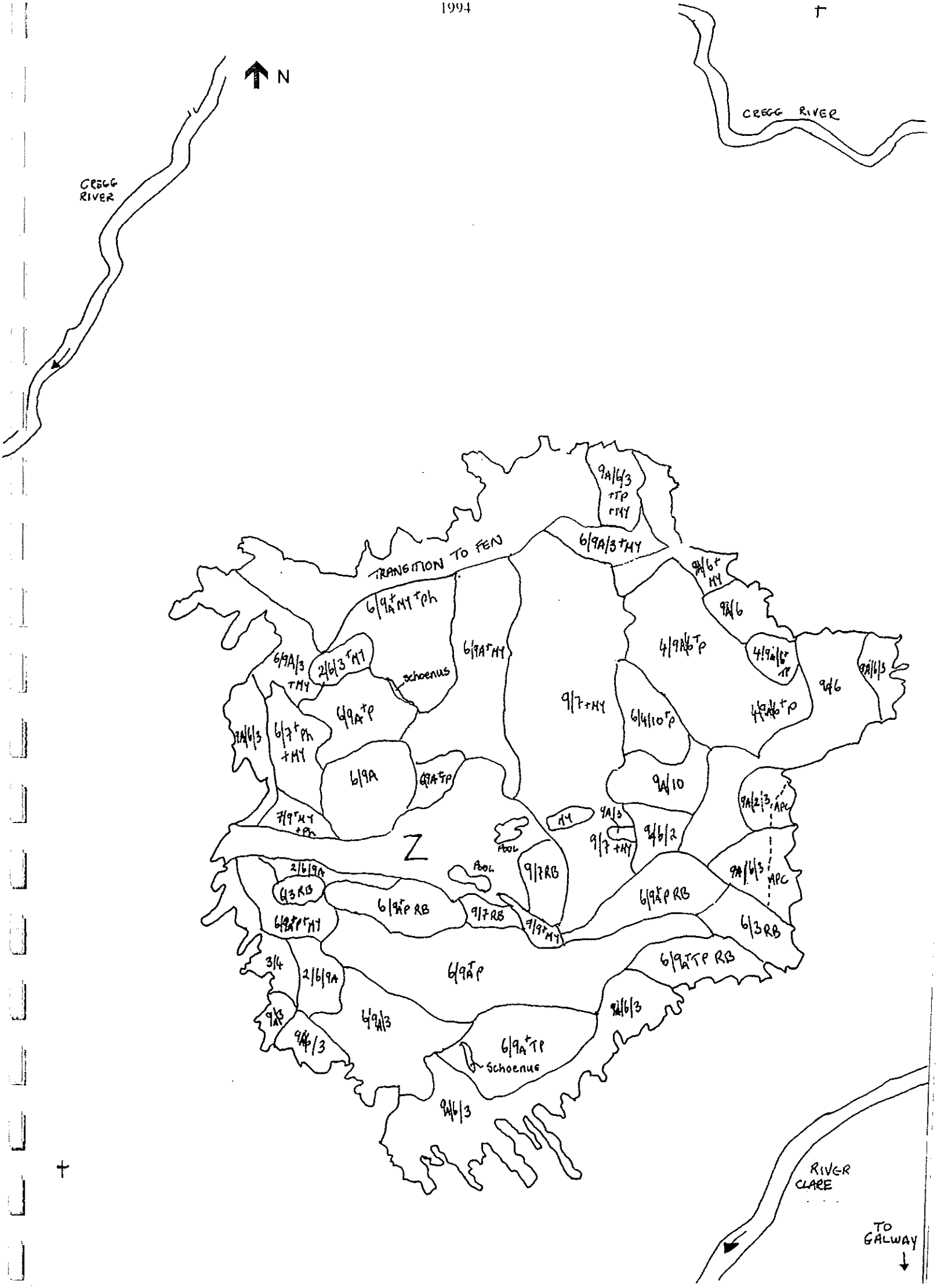
Lara Kelly
Marie Dromey
Malcolm Doak

Raised Bog Restoration Project (1995).

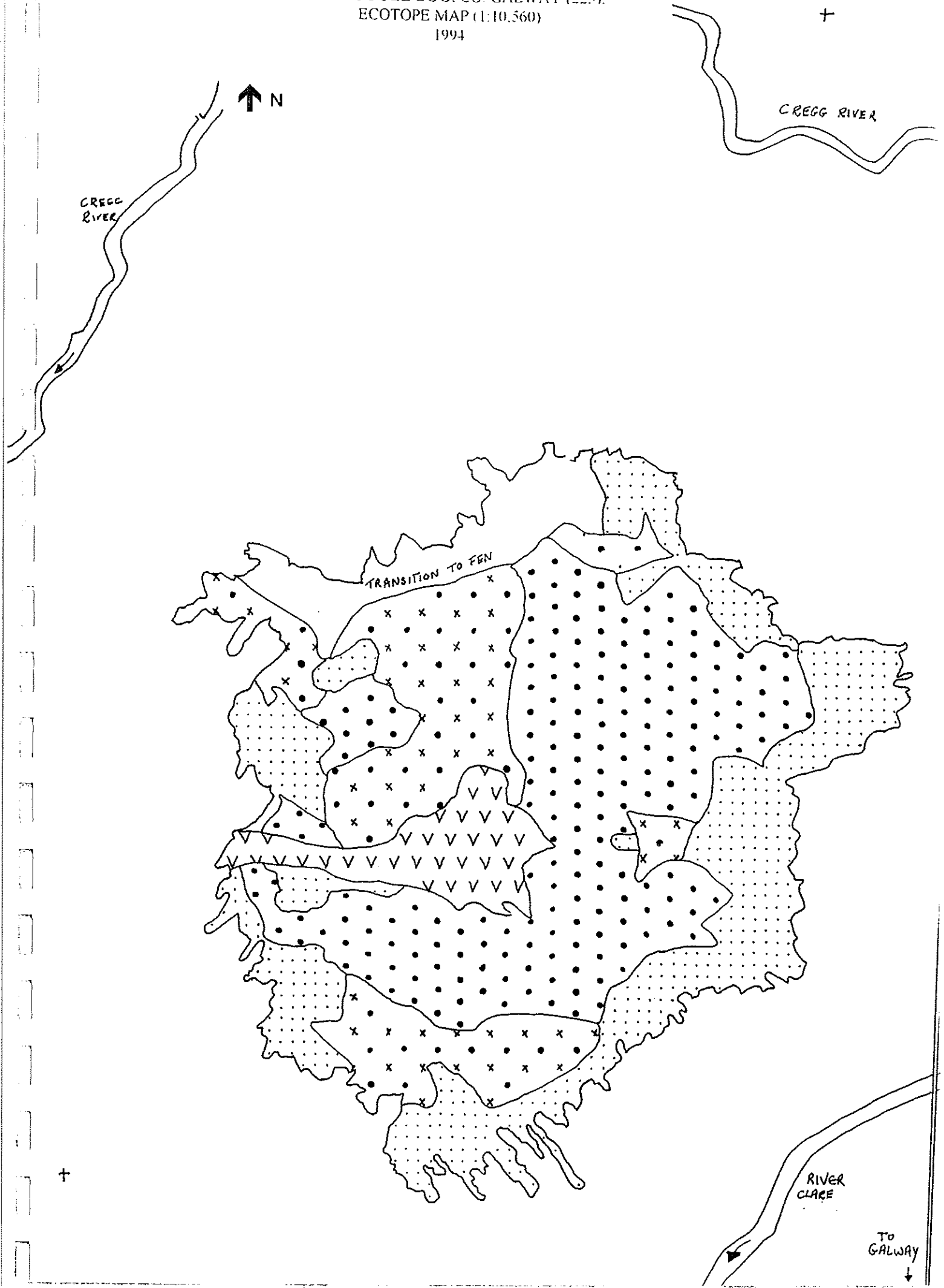
ADDERGOOLE BOG. CO. GALWAY (223).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994



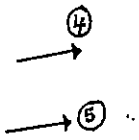
ADDERGOOLE BOG, CO. GALWAY (223).
VEGETATION MAP (1:10,560)
1994

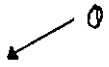


ADDERGOOLE BOG, CO. GALWAY (223).
ECOTOPE MAP (1:10,560)
1994

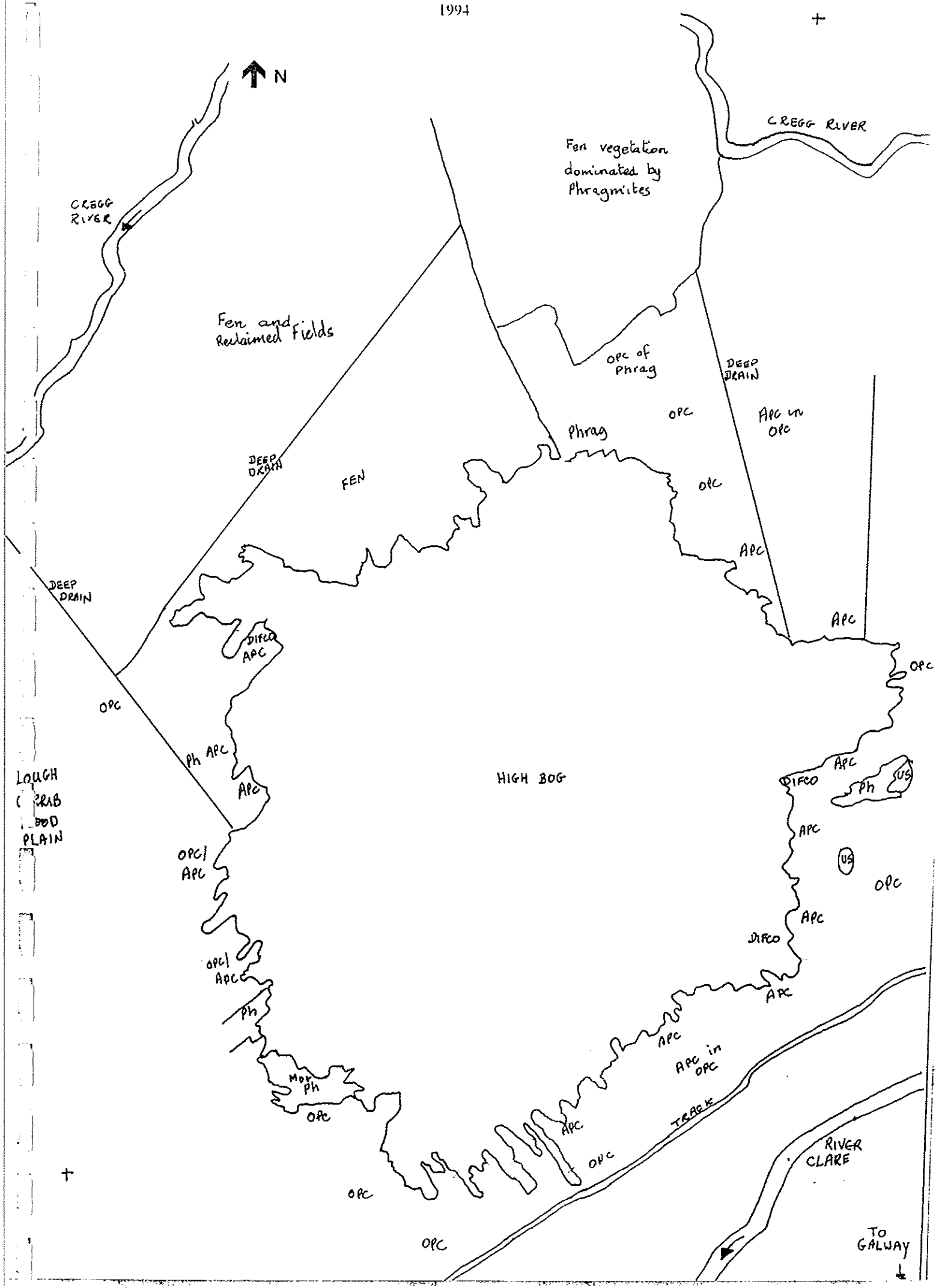


ADDERGOOLE BOG, CO. GALWAY (223).
SLOPES MAP (1:10,560)
1994





ADDERGOOLE BOG. CO. GALWAY (223).
LANDUSE MAP (1:10.560)
1994



BALLYDUFF, CO. TIPPERARY

1. SUMMARY OF SITE DETAILS

NHA No.	641	1/2" Sheet:	15
Grid Ref:	N 01 03	6" Sheet:	TY 5
GSI Aerial Photo:	M 447	1:25,000 Sheet:	17/19 NE
Other Photo:	SC 34058/59 (1993)	Area (ha):	95 (High Bog)
Date(s) of Visit:	7/7/94 (Ecology) 7/7/94 (Geohydrology)		

Townlands: Ballyduff, Walshpark, Clonfinane, Clonraskin and Derrinlieragh.

2. INTRODUCTION

2.1 BACKGROUND

This site was visited by O'Connell and Mooney in 1983 as part of the survey to locate bogs of scientific interest in Ireland. They describe it as a small domed bog with a hollow towards the SE. They describe the bog as intact except for a recent burn to the SW.

The SE was described as the wettest area with two quaking sections on either side of an infilled drain. *Juncus effusus, J. bulbosus* and *Molinia* were noted indicating slightly flushed conditions. To the W of this are excellent *Sphagnum* growth patterns were seen (covering approximately 60 ha).

Ballyduff was given an A rating but was not included in the list of sites to form part of the NNR network (Cross, 1990).

However due to its high rating the site was included in this survey.

2.2 LOCATION AND ACCESS

This site is located approximately 5km to the west of Birr, Co. Offaly. The road from Birr to Portuma runs by the north of the site (T 41). A road off this to the S runs along the E of the site and the site may be accessed at SE corner. However this is through private property and permission should be acquired first or an alternative access point found. Access may also be gained from the adjacent site, Clonfinane, through a mixed woodland at the SW of Ballyduff.

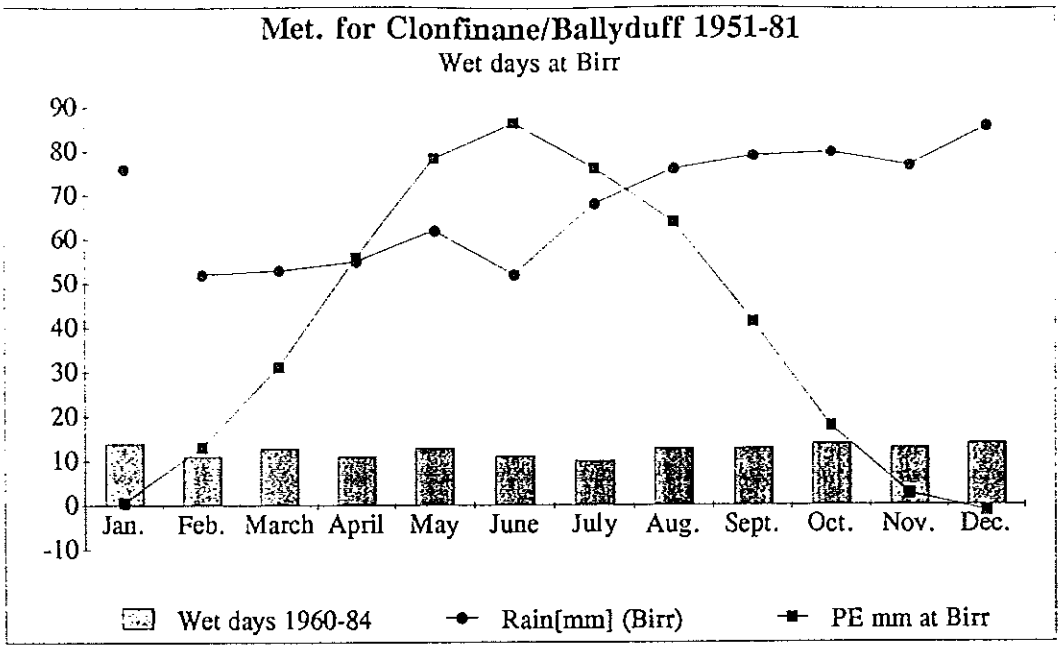
3. METEOROLOGY

No meteorological measurements have been made on Ballyduff bog. Rainfall data from the nearest rainfall station, the Birr synoptic station, for the years 1951-80 indicate that the area receives approximately 816mm of precipitation annually (Fig. 2).

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that the year round actual evapotranspiration (AE) from Ballyduff bog is greater than PE at Birr which had an average PE of 466.5mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Ballyduff would therefore be greater than 466.5mm/yr.

Figure 2:



Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 350mm/yr.

Meteorological data for Ballyduff Bog (1951-1981) are summarised below:

Rainfall (P)	816mm/yr
Actual Evapotranspiration, (AE)	>466.5mm/yr
Potential recharge, (PR)	<350mm/yr
Raindays > 0.2 mm (annual {1951-1980})	207 days

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

This is a relatively flat bog without a pronounced dome which has a sunken area in the centre towards the east of the site. The height of this bog is ~62m OD. In some places close to the bog edge, particularly close to active peat cutting, slopes occur.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

There is rising ground at the western side of the northern edge (PM12:12).

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by Waulsortian Carboniferous limestones (fossiliferous mudmounds).

The Waulsortian limestones generally have a low permeability and are classed as a poor aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

No subsoils data were available for Ballyduff bog apart from the 1840s GSI geology field sheets and recent fieldwork.

Geology of Inorganic Subsoils

Sections in drains in the cut-away areas to the SE indicate that the outer limits of the bog are underlain by clayey till and black lake clay.

5.1.3 Depth to Bedrock

Depth to rock on the bog is unknown.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology

There are some large old drains which run almost the entire length of the site (E/W). A series of very short new drains associated with active peat cutting have been inserted at the N of the E edge of the site. The position of the drains are shown on the Drains and Hydrochemistry Map. They are described below in more detail.

Drain bA is an old, long drain which runs NE/SW for much of its length, at the S of the site. The middle section is difficult to see in the field and is infilled. It follows a townland boundary on the 1910 6" sheet. The E half of this drain has recently been affected by burning. There is a very wet area at the junction of the drain where there is a branch to the NNE (see vegetation description for Flush Z and Drain bA1). Away from the burnt section species seen include *S. cuspidatum, S. auriculatum, S. magellanicum, D. anglica* and *E. angustifolium*. At the W end where this drain is 1.5m wide it is lined with *Pinus* and *Betula* and there is some water ponding. The water table is high. Species in this section include *E. angustifolium, E. vaginatum, Sphagnum cuspidatum, Rhynchospora alba, Drosera anglica* and tall *Calluna*. The drain continues into the mature mixed woodland where it is less well defined.

Drain bA1 is the NE extension of Drain bA and also follows a townland boundary. Between Drains bA and bB which join it there is standing water associated with Flush Z and the species found include *Menyanthes, S. papillosum* and *S. magellanicum*. In addition at the NE end close to the bog edge *Betula* and *Pinus sylvestris* are seen. North of where Drain bB joins this drain *Narthecium* and *Calluna* were recorded and the drain was dry.

Drains bB and bB1 follow a townland boundary at the N of the site. Drain bB runs SE/NW with Drain bB1 to the N/S at the W end. Drain bB is old and infilled with *S. auriculatum S. magellanicum, S. papillosum, S. cuspidatum, E. vaginatum* and *E. angustifolium* at the E end. The water table is high in this section and the drain is 1m wide with about 90cm of water. Pine and *Betula* are seen on this drain in the vicinity of Flush Y and further W. Drain bB1 is infilled with *Narthecium, E. vaginatum* and *Calluna* at its N end with *Betula* encroaching from the edge of the bog.

Drain bC runs N/S at the SE of the site and has been affected by recent burning. It is 0.75m wide with a high water table. It also follows a townland boundary on the 1910 6" sheet. Species found include *S. magellanicum, S. papillosum, S. cuspidatum, Drosera anglica, R. alba, E. angustifolium* and burnt *Calluna*. The S end of the drain is not as wet.

Drain Complex bD is a series of short drains approximately 10m apart which run SE/NW at the north of the eastern edge of the site. They are 1-1.5m deep and are 1-0.5m (at base) wide with 5cm of water flowing to the bog edge. The spoil was thrown up as a slurry between the drains. They have been dug in association with the active peat cutting occurring here. The vegetation between the drains is dominated by *Calluna, Erica tetralix* and *Myrica*.

Drain bE is an old infilled drain which is seen at the north side of Drain complex bD. *Calluna, Myrica* and *Aulacomnium palustre* are seen in the drain with *Betula* along its edge.

Drain bF runs E/W parallel to the N margin. It is 0.5m wide and is infilled with *S. cuspidatum*, *Calluna* and *Eriophorum angustifolium*.

Drain bG also runs E/W parallel to the N edge slightly S of Drain bF. It is 0.5m wide with 50cm of water. It is infilled with unhealthy *S. cuspidatum* and some *E. angustifolium*.

Drain bH again runs E/W parallel to the central section of the northern edge. It is infilled with *S. papillosum*, *Trichophorum* and *Narthecium* with small water filled hollows. The vegetation in this area had been recently burnt.

Drain bK is a short drain which runs E/W and N/S (joining Drain bB at its junction with Drain bB1) at the west edge of the site. It is 0.75m wide and contains stagnant water with *S. cuspidatum* and *E. angustifolium*. It is infilled at its western edge with *Calluna*.

5.2.2 Bog Margin Hydrology

East

There is heavy active hopper-cutting to the east with faces >3m high. The main drain (mF) is 2.5m deep and 1.5m wide. Several deep cut-away drains lie perpendicular to the main drain leading from the hopper faces.

North

Drain mA along the eastern side of the northern edge is approximately 2m below the bog and is 0.5m deep and 1m wide in the vicinity of localised hopper-cutting. It lies in stony till with a silty matrix. The plant species seen indicate minerotrophic conditions - *Galium palustre, Ranunculus flammula, Glyceria fluitans, Mentha, J. conglomeratus, J. effusus, Holcus* and *Salix*. Drain mB further west along the same edge is the main stream for the northwest and it drains old faces adjacent to it. The drain supports *C. echinata, Betula, Salix, Menyanthes, S. magellanicum, S. papillosum* and *Phragmites*. Further west, close to Pine 3 on the high bog the drain supports *Typha, Menyanthes, J. effusus, Narthecium* and *S. auriculatum*.

West

Mature forest lies beside the western faces. Drain mC is the main drain and has been newly deepened, and lies in clayey till. It is 3m deep and 1m wide. Drain mD to the WSW of the site is a newly deepened main drain (part of several) separating this bog from Clonfinane bog. It is 2.5m wide and 1m deep and all lie in stony till. *Phragmites* was seen growing in it.

South

Mature forest lies along this side of the bog. Drain mE is 2x2m with little water.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map).

East

The EC of drain mF was 260µS/cm.

North

Drain mB has an EC of 81-90µS/cm.

West

The electrical conductivity of drain mC was 640µS/cm. Drain mD to the WSW had an EC of 520-680µS/cm.

South

Drain mE had an EC of 400µS/cm.

5.3.2 Laboratory Hydrochemistry

2 x 500ml samples were taken for analysis at the Coillte laboratory as part of this study. Both were taken in the northerly cut-away drain mB.

There are small amounts of all the major ions.

A

Electrical conductivity:	113µS/cm
pH:	6.68
Calcium:	13.63 mg/l Ca
Magnesium:	2.11 mg/l Mg
Total Hardness:	42.72 mg/l CaCO3
Alkalinity:	26.93 mg/l HCO3
Sodium:	9.99 mg/l SO4
Potassium:	1.30 mg/l K
Chloride:	- mg/l Cl
Sulphate:	- mg/l SO4
Aluminium:	- µg/l Al
Iron:	94 µg/l Fe

B

Electrical conductivity:	208µS/cm
pH:	6.83
Calcium:	27.43mg/l Ca
Magnesium:	2.44 mg/l Mg
Total Hardness:	78.53 mg/l CaCO3
Alkalinity:	81.53 mg/l HCO3
Sodium:	9.79 mg/l SO4
Potassium:	0.76 mg/l K
Chloride:	- mg/l Cl
Sulphate:	- mg/l SO4
Aluminium:	- µg/l Al
Iron:	3053 µg/l Fe

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation

Ballyduff bog lies in a regional groundwater recharge zone and is situated at the top of a surface water catchment divide. The underlying limestone aquifer has a low permeability and hence the water-table in this area would be relatively close to the surface.

Bog Regime

This bog has relatively deep drains around all the edges with relatively high electrical conductivity values. Hopper peat cutting occurs to the east. Overall the bog suffers from heavy drainage and it is cut-off from its sister bog Clonfinane by a sequence of deep drains and peat extraction.

Inter-relationship

It is believed that Ballyduff bog lies in a former lacustrine basin which received glaciofluvial inputs of sands and gravels from the west. Groundwater discharges artificially in the deep marginal drains.

6. VEGETATION

6.1 VEGETATION SUMMARY

A large proportion of this site is characterised by *Narthecium* lawns with wet hummock/pool complexes confined to subsidence areas close to old high bog drains. The very wet central core of this site covers approximately 13ha. A large proportion of the site had been recently burnt making it difficult to accurately map vegetation boundaries.

Isolated *Pinus sylvestris* trees are scattered over the site and are invading approximately 200m onto the high bog at the SW of the site. This may indicate that the bog is drying out. *Myrica* dominates an area to the WSW of the site (PM12:15).

The cut-away areas are mainly colonised by scrub *Betula* and *Ulex* though some patches of *Phragmites* occur (see Landuse Map). At the NE corner *Betula* and Pine trees with some *Phragmites* are seen in the cut-away. *Typha* occurs in the marginal drain beside the peat cutting at the NE side of the bog. Most of the N edge has been recently burnt (PM 12:11-13). Where peat cutting is not active, *Betula* and *Phragmites* occur in the cut-away between the high bog and agricultural land. *Phragmites* occasionally encroaches onto the high bog. To the NW in a marginal drain *S. cuspidatum, Menyanthes, Phragmites Osmunda* and *Salix* occur (PM12:10 to NW). At the very NW corner *Betula* and *Ulex* scrub may be seen (PM12:14 along NW edge). *Molinia* and *Pteridium* encroach along the southern edge. At the boundary between Clonfinane bog and Ballyduff to the SW new deep drains have been inserted (PM12:16).

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

The facebank complex dominated by *Calluna* is seen only in places around the site due to the recent burning of the north-eastern and northern edges. At the SE a *Calluna* dominated edge occurs but the *Calluna* is 10-20cm tall with a lot of bare peat, *Campylopus introflexus* and *Cladonia floerkeana* suggesting a fire history and/or other disturbance. In the NE corner this complex has been burnt (RB). *Myrica* is seen in this complex to the SSW of the site where new deep drains separate this from Clonfinane Bog (PM12:15). At the NW of the site there is some *Cladonia portentosa* cover in this complex (1+Cl).

Complex 2

This is seen in a small area at the SE of the site, just behind the facebank complex and along a section of the NW edge. It is dominated by *Trichophorum* (60%) and there is evidence of surface water runoff and some *R. alba* erosion channels are present. There is no acrotelm layer in this complex. At the NW a *Pinus sylvestris* tree occurs in this complex (P3) (PM12:13). *Anthoxanthum odoratum, Holcus lanatus, Luzula, Betula* seedlings, *Calluna* (40cm), *Hypnum jutlandicum, S. capillifolium* and *S. tenellum* were noted under it.

Complex 7 +*Cladonia* +Pine (+*Cl* +Pine)

This complex, dominated by *Calluna* and *Erica tetralix* with a significant *Cladonia portentosa* (20%) cover, occurs at the SW of the site. *E. vaginatum* is also common with some *S. capillifolium, S. subnitens* and *Leucobryum* hummocks. *Pinus sylvestris* (5 m tall close to edge) with numerous pine and *Betula* seedlings are encroaching from the bog edge (PL12:23 and 24). The bog surface is mostly dry and hard although surface water was seen in places.

Complex 6/2
Between Complex 2 and Complex 6B at the SE of the site there is an area where *Narthecium* and *Trichophorum* co-dominate. The *Sphagnum* cover is higher than in Complex 2 but is not as well developed as in Complex 6B.

At the southern side of the site S of Complex 6B there is an area dominated by *Narthecium* (40%) and *Trichophorum* (20%) with low *S. capillifolium* hummocks (5%), some small *S. fuscum* hummocks and small amounts of *S. papillosum* and *S. magellanicum*. Small water filled algal hollows are frequent. The *Calluna* (20%) is mostly short but there are some taller isolated patches (40cm). *Carex panicea* also occurs. The whole area has a rather uniform structure. The acrotelm layer is variable but it is mostly not present.

Complex 6RB
This complex seen to the NE of the site and along the northern edge. It is also dominated by *Narthecium*, up to 70% in places. It has been very recently burnt, probably in early 1994. The burn appears to have more or less destroyed the *Sphagnum* layer (PL12:12), the remains of which are very dried out. Small amounts of *S. capillifolium* and *S. papillosum* survive. The *Calluna* and *Erica tetralix* have also been badly burnt but there is some regrowth. Algal hollows are also present with some patches of *Carex panicea*. At the NE corner, to the E of Drain bA1 and N of Drain bE the ground is hard and tussocky. Small *Leucobryum* hummocks are frequent in this area. To the N of Flush Z a group of *Pinus sylvestris* trees (P1) (one 3 m tall and two 2 m tall) with a number of seedlings occurs in this complex. *S. papillosum, S. cuspidatum, Aulacomnium palustre, Vaccinium oxycoccus, Andromeda, Luzula, Narthecium* and *Trichophorum* were present under these trees.

Sub-Marginal Complexes
Complex 9A
This is an *Eriophorum angustifolium* dominated area which occurs at the northern side of the site. It appears to be in a slightly sunken area which water ponds. Algal pools make up 25% of the cover and there are some small hollows which contain *S. cuspidatum* (5-10cm of water). *S. magellanicum* and *Leucobryum* hummocks occur in between the algal pools with *E. vaginatum, Calluna, Erica tetralix* and *Trichophorum*. There is a lot of surface water and the surface is tussocky due to the algal pool cover.

Complex 6B
This is seen to the SE and E of the bog and in a band just N of Flush Y. It is dominated by *Narthecium* lawns (25%). There is evidence that it has been burnt in the past as the structure is poor, most of the micro-topography falling within the 0-10cm classification and there are no tall hummocks (PL12:11 and 25). In addition *Campylopus introflexus* and *Cladonia floerkeana* occur frequently. The dwarf shrubs make up 40% cover but only reach 20cm in height. *Trichophorum* tussocks cover 15% and small algal hollows also occur. The *Sphagnum* cover is moderate reaching 20% in places with *S. tenellum, S. capillifolium* (small hummocks), *S. magellanicum, S. subnitens* and *S. papillosum*. A small lodgepole pine was seen in this complex close to the SE corner. On the approach to Complex 15 at the north of this complex algal hollows increase in frequency and there is a crispy algal layer over much of the *Narthecium* lawns suggesting that they are flooded during the winter. N of Flush Y there is frequent scattered *Carex panicea* in this complex (15% in places). The bog surface under this complex is, for the most part, wet and spongy and an acrotelm layer is present.

Complex 6
This is seen in the NW corner of the site. It is dominated by *Narthecium* lawns with *R. fusca* and algal hollows. The surface is tussocky due to the presence of the small algal hollows. *Racomitrium* was seen in this complex and *Drosera intermedia* may be present. Two *Pinus sylvestris* tree occurs in this complex. P4 is 3.5m tall and is surrounded by tall *Calluna* (1m). *Hypnum jutlandicum, S. fimbriatum* and *S. capillifolium* were recorded under the tree. P5 has burnt and unburnt pines (3m) with 3 *Betula* (2.5m) and *Betula* seedlings. *Calluna* (1.5m tall), *Dryopteris dilatata, S. capillifolium, S. papillosum, S. palustre, Aulacomnium palustre, Pleurozium schreberi, Hypnum jutlandicum* and *Plagiomnium* sp. were recorded under these trees.

Complex 6 +*Cladonia* (Cl)
This occurs to the east of Complex 6++*Cladonia* where the *Cladonia portentosa* cover is approximately 5% and the *E. vaginatum* cover is lower. Some large *S. imbricatum* hummocks may be seen in this complex. Towards the SE corner there are a lot of algal linear pools. Overall an acrotelm layer occurs in this complex but towards the SE corner the surface is tussocky and hard underfoot. A group of *Betula* scrub (B1) is seen in this complex on a small *Calluna* mound. *S. imbricatum* is also seen around the edges of the mound.

Complex 6+ +*Cladonia*
At the W of the site the *Narthecium* complex occurs with a 15% cover of lichens, mainly *Cladonia portentosa* and some *C. uncialis*. The *E. vaginatum* cover is high and *Calluna* reaches 20cm in height. This suggests that burning has not occurred for some time. The *Sphagnum* cover is moderate (30%) consisting mainly of *S. capillifolium, S. tenellum* and *S. papillosum. Pinus sylvestris* and *Betula* with some *Molinia, Myrica* and *Potentilla erecta* are invading this complex from the bog edge.

Sub-Central Complexes
Complex 6/10RB
This is seen between Complex 6RB and Flush Y and in a small area within Complex 6B at the SE of the bog. *Narthecium* is still common but the *Sphagnum* layer is well developed (45%). However due to the recent burn the Sphagna are not looking very healthy. The surface is still spongy so the burnt Sphagna are still creating acrotelm conditions. There is some regeneration of *Sphagnum* in places Patches of *Carex panicea* and some algal hollows are seen. There are some small unburnt areas in this complex which could not be mapped.

Complex 10/6RB + *Myrica*
This recently burnt complex is seen covering a very small area to the N of Flush Y where the *Sphagnum* cover reaches 80% in places. It was difficult to map the boundaries due to a recent burning event. The *Myrica* was approximately 30cm tall but now consists of burnt stems with short re-growth from the base.

Central Complexes
Complex 10/15
This occurs close to the S side of Flush Z, around Drain bA and in the vicinity of Drain bB (PM12:9). The *Sphagnum* cover is 100%, mainly *S. magellanicum* with *S. cuspidatum* and *S. imbricatum*. Rounded *S. cuspidatum* pools cover 40% and contain *R. alba, Drosera anglica, Menyanthes* and *Eriophorum angustifolium*. These pools contained 10cm of water at the time of the survey. The inter-pool areas are dominated by low hummocks of *S. imbricatum, S. magellanicum* and *S. papillosum* with *Calluna, Erica tetralix* and *Eriophorum angustifolium* with some scattered *Myrica*. The surface is very wet and quaking indicating an acrotelm layer (PM 12:9).

Because of the recent burn it was difficult to map the edges of Flush Y in this complex.

Complex 15
This central wet complex consists of *S. cuspidatum* lawns/pools (40%) which contain *Menyanthes, R. alba, Drosera anglica* and *Eriophorum angustifolium*. The inter-pool areas are dominated by *S. imbricatum* and *S. papillosum* with *Calluna, Erica tetralix, E. angustifolium, E. vaginatum* and *Trichophorum*. The N side has been partly burnt and *Narthecium* is more common (15RB). At the NW side of this complex two *Pinus sylvestris* trees (5 m tall) are seen (P3). They are surrounded by pine seedlings and the following species were noted in the immediate vicinity: *S. fimbriatum, S. capillifolium, Aulacomnium palustre, E. vaginatum* and *Luzula*. At the W end of this complex there is no *Menyanthes* in the *S. cuspidatum* pools and *S. auriculatum* is present in some. There is also a higher occurrence of algal pools. The *E. vaginatum* cover is high but there is a rather uniform topography with no large hummocks. At the SW there is some structure and *Cladonia portentosa* is seen on the hummocks.

6.2.2 Flushes

Flush Z is located in the east central section of the site where a number of old infilled drains converge and where the bog is slightly sunken with the highest ridge to the S. The *Sphagnum* cover is about 90% with permanent pools (PM12:8). One large infilled pool was seen which contained *S. cuspidatum, R. alba, D. anglica, E. angustifolium, E. vaginatum, S. recurvum, Vaccinium oxycoccus* and *Andromeda*. However the whole area had been recently burnt and the *Sphagnum* layer N of the convergence of the drains had been damaged and was dry (PM12:6). The *Sphagnum* layer appeared to be mainly *S. capillifolium*. The *Calluna* had also been burnt (burnt stems 1 m tall) as had the *Myrica* (PM 12:7). The latter was re-growing from the burnt stem bases.

Flush Y

This is a small flush seen within Complex 10/15 on Drain bB. It consists of *Pinus sylvestris* and *Betula* trees with tall *Calluna* (60cm). *Aulacomnium* is common covered with *Vaccinium oxycoccus* with other species such as *Menyanthes, Dactylorhiza maculata, S. capillifolium* and *Pleurozium schreberi*. *Myrica* extends from through this complex from the E almost as far as this feature. The vegetation to the N and E of this flush had been recently burnt (PM 12:10).

7. BOG TYPE

This bog has been classified as a Ridge River B bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes

A number of slopes were estimated in the field. They are described below and their positions are shown on the Slopes Map.

Slope 1 The slope into active hopper peat cutting at the SE corner of the site is 1m over 70m. *Pteridium* and *Betula* are encroaching onto the high bog in this area. The facebank is 3-3.5m high and the peat surface is cracked in places.

Slope 2 The slope, through a recently burnt area of the high bog into active peat cutting at the eastern edge of the bog, is 0.75m over 50m. The facebank here is 2m high and there is slumping and cracking of the peat surface. The whole of the eastern edge has an undulating appearance with slopes more acute where peat cutting has extended further into the site (PL12:13 to N).

Slope 3 This slope is into active peat cutting to the east of the site through the complex of drains bD on the high bog. It is 1m over 70m. The ground is very dry and hard in this region.

Slope 4 At the NE corner of the site the slope into old peat cutting is 0.75m over 30m with severe cracking and slumping of the high bog surface (PL12:15).

Slope 5 This occurs at the E of the N edge of the site. The slope northwards from the high bog into a deep mesotrophic marginal drain and reclaimed fields is 1m over 30m.

Slope 6 This slope at the middle of the northern edge from the high bog into *Phragmites* and burnt old peat cutting is 1m over 30m. Rising mineral ground is seen just to the N.

Slope 7 This slope is seen at the NW of the site where the high bog edge is collapsing into the cut-away. The facebank is 2.5 high and the slope is 0.5m over 50m with bad cracking and slumping of the high bog peat surface.

Slope 8 The slope at the central section of the southern margin, through *Molinia* into mixed woodland, is 0.5m over 50m. The remainder of this edge to the east has a more gradual slope but *Molinia* is still encroaching about 30m onto the high bog.

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

Peat cutting is presently most active along the eastern and north-eastern edges with a small area to the NW (PM12:14). Machine tracks on the high bog are evident and they have caused severe damage in the vicinity of Drains bG and bH. To the west and south woodland is seen along the bog edge and no active peat cutting was evident. To the east recent drains (Drain complex bD) have been installed on the high bog in association with peat cutting. The north-eastern third and northern edge have recently been severely burnt. This burning appears to have spread from the cut-away areas. New deep drains may be seen at the SW of the site in the area which adjoins Clonfinane bog. The bog edge has been messed up here and *Rubus, Myrica* and *Ulex* are seen (PM 12:16 to the SW).

8.2.2 Forestry and Woodland

Mixed coniferous and deciduous woodland is seen along the western and south-western edges of the bog. These woodlands are indicated on the 1910 6" sheet of the site, the former being called Derrylahan. *Pinus sylvestris* and *Betula* are invading the high bog surface from these woodlands particularly at the SW, where the pines are extending approximately 100m onto the high bog. At the NW the wood is a mixed deciduous one dominated by *Betula* with *Quercus, Fraxinus, Crataegus monogyna, Corylus, Ilex, Fagus* and *Sorbus aucuparia*. Cattle pass through this woodland onto the high bog by-passing an old fence. Similar species are seen in the woodland to the S and SW of the site.

8.2.3 Fire History

The north-eastern third and along the northern (PM12:11) edge of the site had been recently burnt (possibly spring 1994) when surveyed. Close to the bog edge this burning was severe destroying the *Sphagnum* layer. The *Calluna* and *Erica tetralix* was also badly burnt. This burning extended into the central wet section of the site. In the wetter areas the *Sphagnum* appears not to have been as badly affected by the fire but the dwarf shrubs were burnt. Patches of *Myrica* were also burnt but there was regrowth from their bases (PM12:7).

8.2.4 Cattle Poaching

At the west of the site cattle gain access onto the high bog through the woodland at the edge of the bog. An electric fence was fencing off part of the high bog around this woodland. The surface of the bog here has been poached by cattle and was very tussocky and hard underfoot.

8.2.5 Agricultural Improvements

At the eastern side of the N edge fields are being improved and the drains at the bog edge deepened considerably. The fields are 2m below the high bog.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. A depression at the centre of the site is associated with the wettest areas. This may be due to subsidence. A number of old drains coincide in the centre of the site.

2. The effect of peat cutting on the vegetation cover has been most significant to the N and NE of the site where there are some steep marginal slopes.

3. Deep marginal drains at the S of the site have caused drying out of the southern edge of the bog.

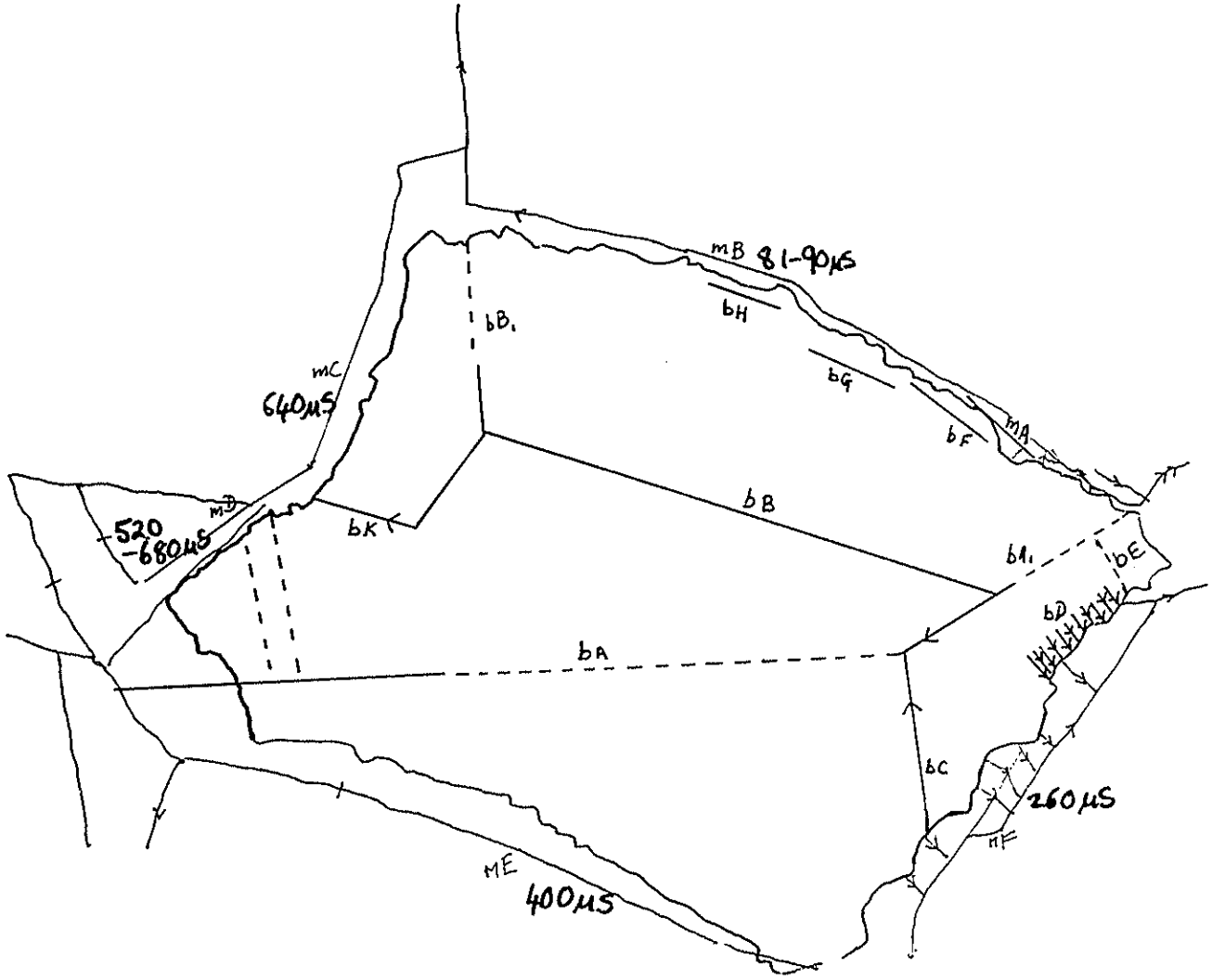
4. *Phragmites* is seen along northern edge and there may be potential for lagg restoration in this area.

5. *Pinus sylvestris* encroaching into the site suggesting that some drying out of the bog surface may be occurring.

6. Burning has also affected the vegetation cover with very few large *Sphagnum* hummocks seen.

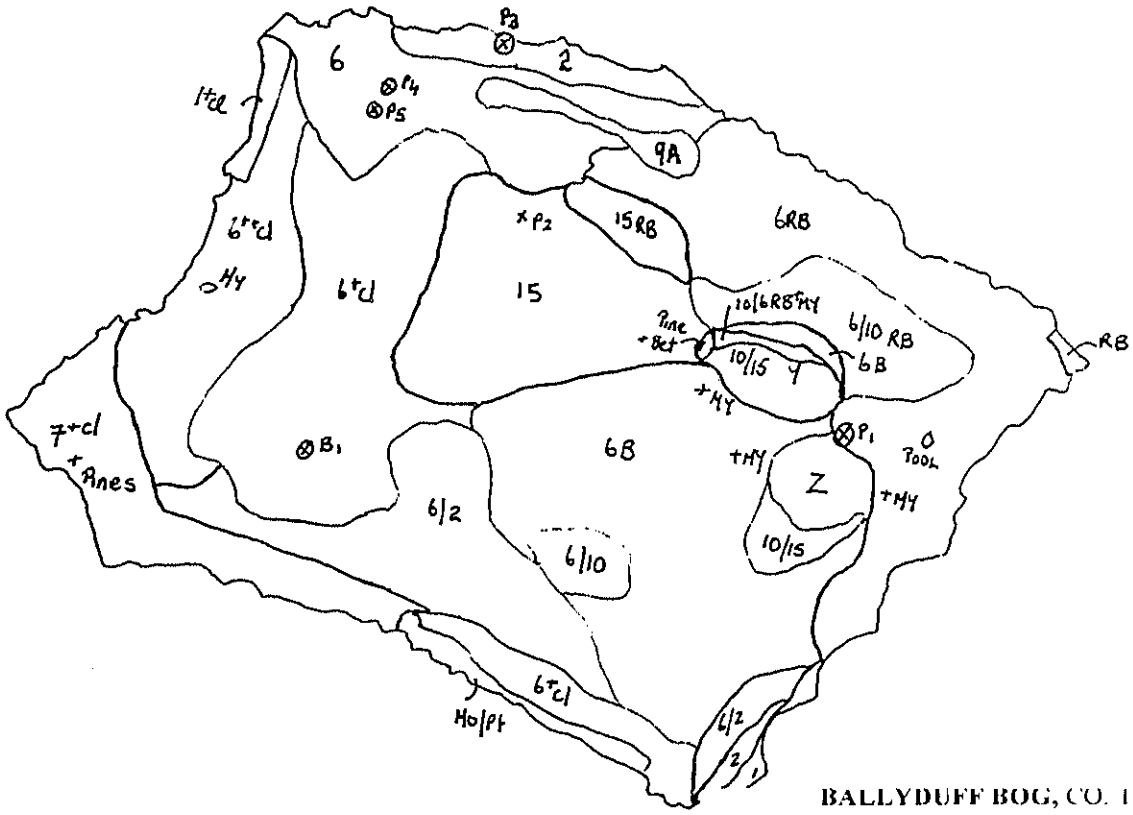
Lara Kelly
Marie Dromey
Malcolm Doak

Raised Bogs Restoration Project (1995).



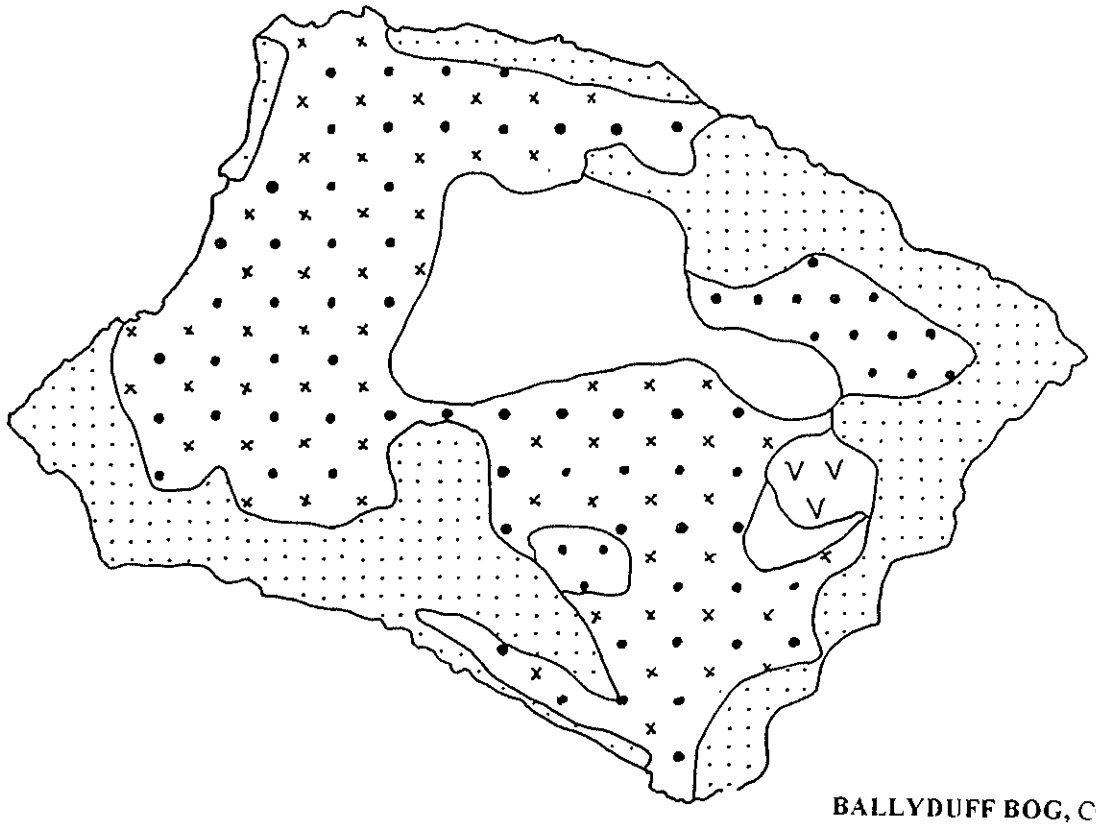
BALLYDUFF BOG, CO. TIPPERARY (641).
DRAINS AND HYDROCHEMISTRY MAP (1:10.560)
1994

N



BALLYDUFF BOG, CO. TIPPERARY (641).
VEGETATION MAP (1:10,560)
1994

N



BALLYDUFF BOG, CO. TIPPERARY (641).
ECOTOPE MAP (1:10,560)
1994

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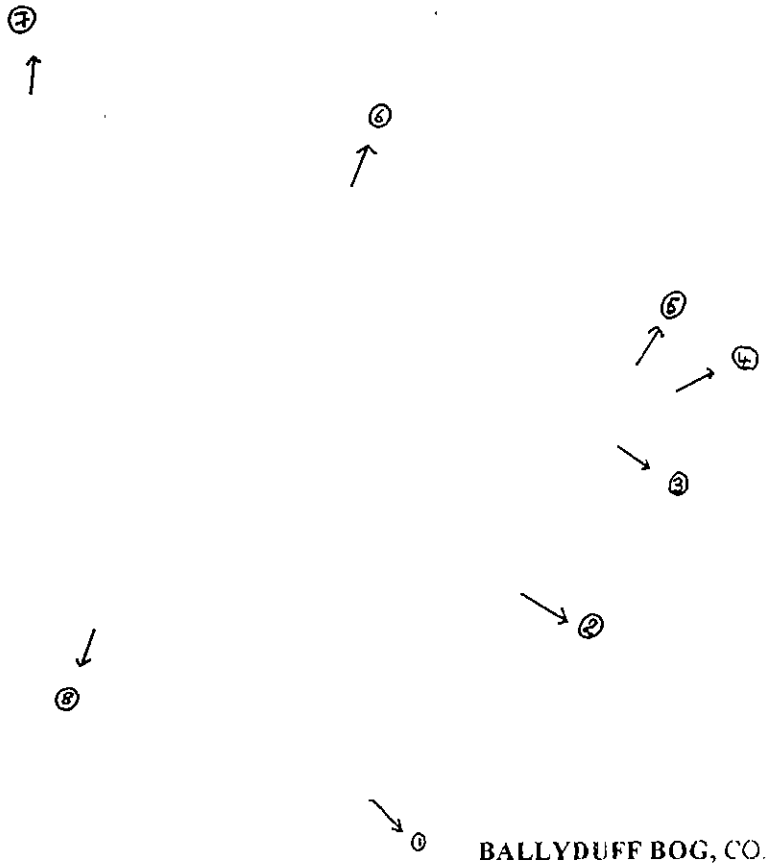

BALLYDUFF BOG, CO. TIPPERARY (641).
SLOPES MAP (1:10,560)
1994

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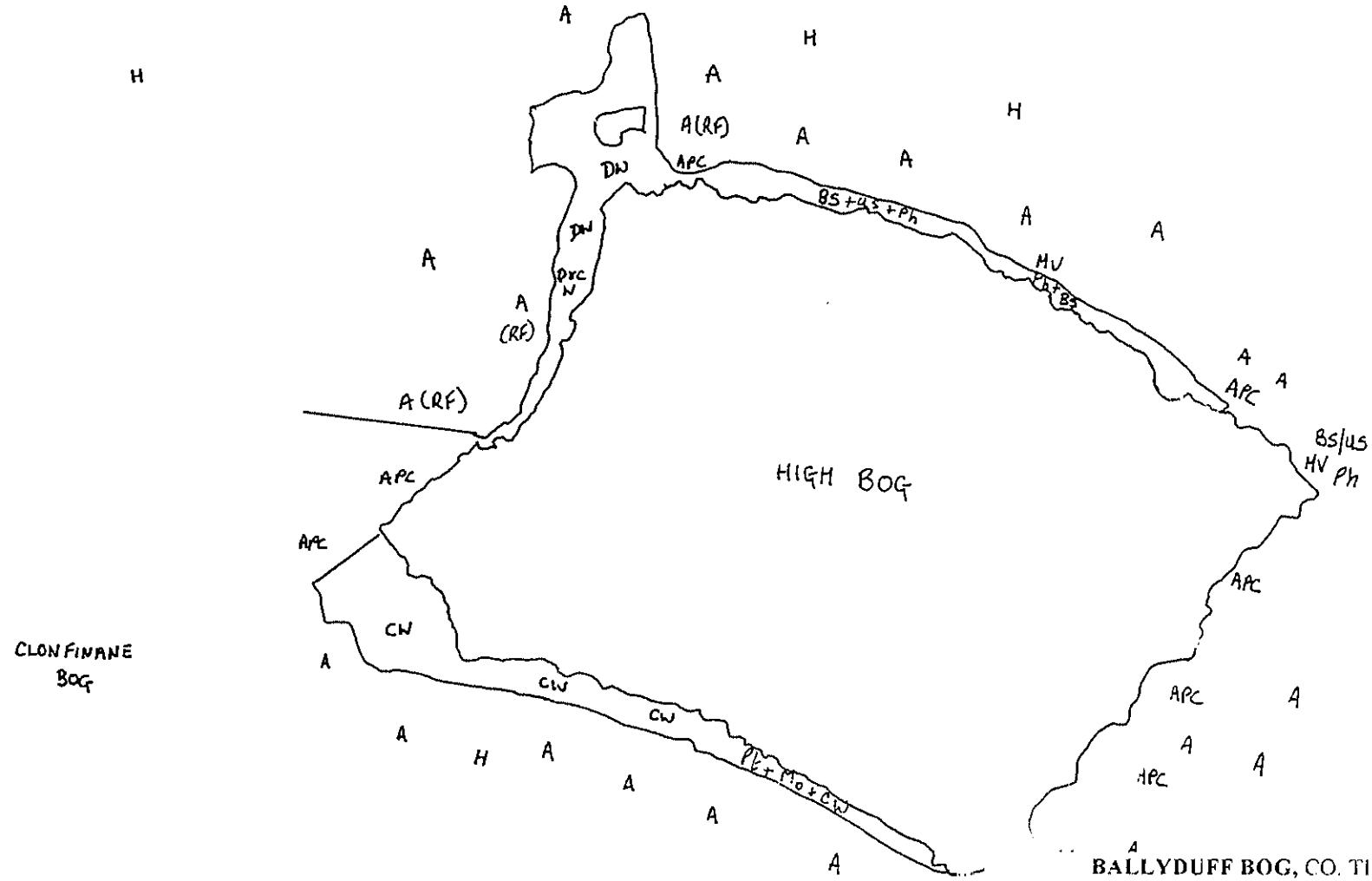


BALLYDUFF BOG, CO. TIPPERARY (641).
LANDUSE MAP (1:10,560)
1994

BALLYKENNY, CO. LONGFORD

1. SUMMARY OF SITE DETAILS

NHA No.	(1439) 441	1/2" Sheet:	12
Grid Ref:	N 02 79	6" Sheet:	LD 6
GSI Aerial Photo:	N 48	1:25,000 Sheet:	20/27 SE
Other Photo:	OS (B/W 1993) 11898 OS (Col. 1993) 6266	Area (ha):	177.0 (High Bog)
Date(s) of Visit:	26-4-94 (Ecology) (Geohydrology)		

Townlands: Castleforbes Demesne and Killeen.

2. INTRODUCTION

2.1 BACKGROUND

This is one of two bogs in Co. Longford which almost adjoin each other. It is separated from Fisherstown Bog to the SSW by the Camlin River. There were only four raised bogs in Co. Longford which were listed for inclusion in a conservation network (Cross, 1990). One, (Clontymullen), has already been severely damaged. The two bogs listed above were also selected by Cross (1990) for inclusion in a Nature Reserve Network because " they are the best remaining examples of flood-plain bogs ..... the complex grades into callows along the Camlin and Shannon Rivers and is utilized by Greenland White-fronted geese". In the same report both bogs were assigned a Bi rating indicating that they were good quality sites though the hydrology was somewhat damaged. Wet, soft and quaking areas were found in both.

Both sites were surveyed by Douglas and Grogan (1986) as part of the National Raised Bog Survey. Several old drains were noted on Ballykenny and this had resulted in drying of the bog surface especially at the N end. The S section of bog was found to be in good condition with well-developed hummocks. However, no very wet areas were noted. The margins were fairly intact.

The site was included as part of this survey as previous surveys indicated that it was important from a nature conservation viewpoint and its conservation would ensure the preservation of the N/S gradient variation of raised bogs. This being the case it is necessary to assess its present status and conservation potential.

In the final assessment of sites this bog was combined with Fisherstown to form a complex site.

2.2 LOCATION AND ACCESS

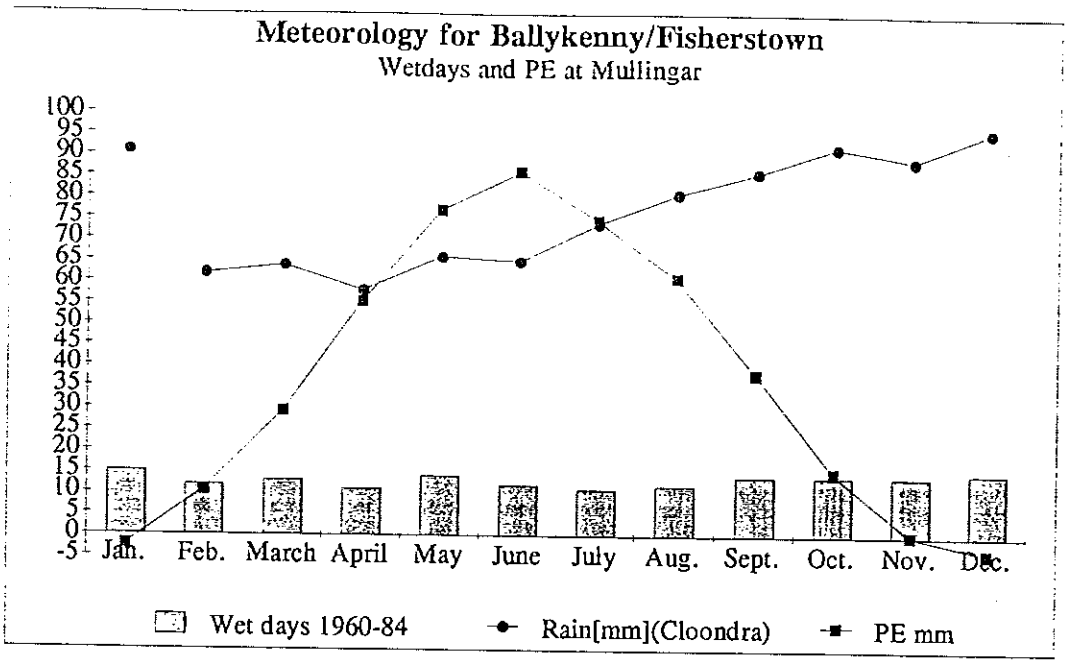
This medium sized raised bog is one of the group of three northern Midland raised bogs and is located in Co. Longford, 6.5km NE of Longford town. Lough Forbes lies to the west of the site, while the Camlin River runs to the south. Castle Forbes Estate borders the northern edge. Corlehan Wood a mixed woodland lies between Lough Forbes and the bog on the western edge. The bog is privately owned. This site appears to be at a lower elevation than Fisherstown (in the field).

Ballykenny may be accessed from the Longford to Sligo road. Turn left at Newtown Forbes just before the church and follow the road past some houses. It then narrows and a lane veers to the left which leads onto the bog. Follow the track to the end and the SE end of the site may be accessed. There are some difficulties getting onto the high bog as the face bank is high in this area and drains have to be crossed (watch out for numerous fat rats!).

3. METEOROLOGY

No meteorological measurements have been made on Ballykenny bog. Rainfall data from the Cloondara rainfall station 2km SSE. for the years 1951-80 indicate that the area receives an average 923mm of precipitation annually (Fig. 3). The nearest Meteorological Service synoptic station is to the SE, at Mullingar.

Figure 3:



Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that the year round actual evapotranspiration (AE) from Ballykenny bog is greater than PE at Mullingar, site of the nearest synoptic station which had an average PE of 442mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Ballykenny would therefore be greater than 442mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 481mm/yr.

Meteorological data for Ballykenny Bog (1951-1981) are summarised below:

Rainfall (P)	923mm/yr
Actual Evapotranspiration, (AE)	>442mm/yr
Potential recharge, (PR)	<481mm/yr
Raindays @ Birr > 0.2mm (annual {1951-80})	218 days

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE BOG

Overall this site is rather flat particularly the southern section where there is only a gradual slope to the bog edge. The steeper slopes are confined to the areas beside the peat cutting to the SE and towards the large drains in the northern part of the site.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

This bog is situated at a wide point in the River Shannon valley and lies in its former floodplain.

5. HYDROLOGY

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by shallow water bioclastic Carboniferous limestones (shown as SHL, on map).

This limestone would generally have a moderate to high permeability, depending on its degree of karstification and number of fissures. The SHL limestones are generally classed as a local moderately productive aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

No subsoils data were available for this bog apart from the 1840s GSI geology field sheets and recent fieldwork carried out for this study.

Geology of Inorganic Subsoils

Generally there was little exposure. Clays and clayey limestone till were noted in the cut-away areas to the SW.

5.1.3 Depth to Bedrock

Depth to rock on the bog is unknown although subsoil deposits are suspected to be >10m depth since the bog lies in a floodplain area.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology

A study of recent aerial photography revealed that no new drains had been inserted since 1985 though peat cutting had intensified along the mid-eastern edge of the site. The drains and their direction of flow are illustrated on the Drains and Hydrochemistry Map.

South

Drain bB is an old, three sided double drain on the southern side of the site. The flow in the eastern and western parts is to the SE. It is almost infilled with *Eriophorum vaginatum*, *Sphagnum cuspidatum*, *S. magellanicum*, *J. effusus* and *Calluna*. The edges support *Betula*, *Cladonia subservicornis* var. *verticillata* (PL6:11 and 12) and bryophytes, including *Dicranum scoparium*, *Polytrichum alpestre* and *Aulacomnium palustre*. The ground between the drains is very hard with little *Sphagnum* growth and dominated by *E. vaginatum*. The EC in the eastern arm is 73 µS/cm. The northern section of this drain has hard mounds (spoil) with *Calluna* (0.75m tall). The most northerly of the double drains carries at lot of water and the flow is to the S in the northern part (PL6:14 to NE along Drain bB).

Drain bC is a short old drain which exits to the S on the SE edge. It is infilled with similar species to Drain bB with the addition of *Dryopteris dilatata* and *S. palustre*.

Drain bE runs from the northern section of Drain bB south into Drain hD. There is a very rapid flow of water to the S (EC 80 µS/cm). The drain is deep, partially under ground at times and over hung by tall *Calluna*. The edges are dry and support tall *Betula* (up to 5m) with *Rubus, Dryopteris* and *E. vaginatum* and little *Sphagnum*. *Ulex* follows this drain on to the bog at the southern end.

West

Drain bF is the drain which runs across the centre of the site in an NE/SW direction along a townland boundary. At the NE end there is considerable flow into the cut-away. This section of the drain is colonised by *S. cuspidatum* and *E. vaginatum* while in addition the central part, which is wider (2m) and wetter supports *Drosera anglica*. The SW end is drier with tussocks of *E. vaginatum, Molinia, Succisa pratensis, Calluna* (1m tall), *Betula* and *Rhododendron*. This section is deep and over hung by *Calluna* (EC 96 µS/cm). The face bank complex is seen along the edges.

Drain bG is an old drain at the western edge of the site running roughly N/S. It is not easily seen in the field. It is infilled with *S. cuspidatum* and *Calluna* with *Pinus* and *Rhododendron* in the vicinity.

Drain bH is an old drain at the NW side of the site which is infilled. *Betula*, tall *Calluna, E. vaginatum, Polytrichum alpestre, Aulacomnium, Hylocomium splendens, Pleurozium schreberi* and *Sphagnum capillifolium*.

North

Drains bJ and bK are old parallel drains at the northern side of the site. They are at least 2m deep and are hazardous and difficult to cross. They are completely dominated by *Myrica* (1.5m tall), *Calluna, Molinia, Betula* with *S. capillifolium, S. papillosum* and *E. vaginatum* at the eastern end of Drain J. There is flow in both of these drains to the west (PM3:18 W along bJ).

Drain bM (EC 113 µS/cm is the out-fall from Flush Y) is a deep drain which flows to the W into Lough Forbes cutting off 20% of the northern end of the site. The drain is covered by *Molinia* with *Betula, Pinus, Rhododendron*, tall *Myrica* and *Calluna, Rubus* and *Vaccinium myrtillus*.

Drain complex bN are a series of N/S drains in the northern section. EC ranges from 76-82 µS/cm apart from Drain bN_1 where the EC was 114 µS/cm. In general these drains are infilled with *Betula, Molinia, E. vaginatum, Calluna, Vaccinium myrtillus* and *Pinus* with some *Salix*. The face bank complex extends along the edges of most of these drains (PL6:23 to W). Most of these drains are extensions of drains coming from Castle Forbes Estate. This drained section is a lower level than the rest of the bog by 3-4m (PL6:22 to S PM3:21 to SE). Flow was not detected in these drains at the time of the survey in April, 1994.

5.2.2 Bog Margin Hydrology

East

This is the main zone of cutting and is the only side of the bog that does not extend to its original extent. At drains mA, the faces are 2-3m high with 1-2m wide face drains; there is also widespread dumping here. Drain mA is 2m wide by 2-3m deep. There is no flow (EC 150 µS/cm). It is colonised by species such as *Juncus effusus, Cardamine pratensis, Nasturtium officinale* and *Potamogeton* sp.

North of mA widespread hopper-cutting has occurred and only some is ongoing, causing a large part of the bog to be removed. A distance of 400m separates the present bog faces from the track. Many drains mB, run perpendicular to the bog track and are 2m deep in places. Often the faces are relatively old and overgrown. To the NE the faces are overgrown as is the cut-away. There appears to be a lobe of till on the high bog which is covered in trees. A small drain bP, leaves this area and flows NE.

North

There is no access to the faces in the N since they are overgrown with *Rhododendron* trees. However, the original extent of the bog remains. There is a small amount of old cutting to the very N tip at drains mN. Faces are 3m high and face drains are 3m wide.

South
Drain mD runs along the southern margin of the site beside what appears to be an old track with a considerable flow to the E (EC 67 µS/cm). It is 1.5m deep. The vegetation in the drain consists of *Agrostis stolonifera, Rumex sp., Juncus effusus, Dryopteris, Pteridium* and *Molinia*. Along the drain edge *Betula, Ulex, Rubus* and *Rhododendron* grow.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydroehemistry (See Drains and Hydrochemistry Map).

East
The electrical conductivity of mA is ~100µS/cm. The ECs of drains mB are <150µS/cm. The electrical conductivity of drain bP was 235µS/cm.

North
At drain mN the electrical conductivity was 100-450µS/cm.

5.3.2 Laboratory Hydrochemistry

No samples were taken for analysis at the Coillte laboratory.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
This bog is situated entirely in a wide low gradient floodplain of the River Shannon and lies within a regional groundwater discharge zone.

Subsoils are thick and are generally of low permeability.

Bog Regime
There are few drains on the high bog and in the cut-away apart from the east side at drains mB.

The electrical conductivities are all less than 100µS/cm apart from those marked on the drains map. Local groundwater artificially discharges in the cut-away area to the N of the bog at drains mN.

Inter-relationship
The bog probably initiated in marsh/fen areas within the River Shannon floodplain. The bog is susceptible to periodic flooding particularly around its edges. The dome is too high to be totally emerged in water. Callows may form at the bog edges along slight slopes to river water. Although in a groundwater discharge area the bogs is quite separate from the aquifer below since thick confining clays underlie the bog and callows. The deeper regional groundwater is likely to flow under the floodplain via a confined aquifer and exfiltrate directly to the river which has cut deep into the clay (Hooyer, cited in EU FAEWE project [in press]).

There is a natural gradation from bog to the Camlin river, in the SW, where there are large expanses of callows (nature reserve) which are undisturbed. There is artificial discharge of local groundwater in the extreme N, coincident with cutting.

6. VEGETATION

6.1 VEGETATION SUMMARY

The vegetation of this site is relatively uniform with very little community diversity and the *Sphagnum* cover is moderate (30-60%) over much of the high bog. The high bog vegetation is characterised by *Narthecium*, *Calluna* and *Sphagnum capillifolium* with *Eriophorum vaginatum*. The northern section is dry and has a low *Sphagnum* cover with *Pinus sylvestris* and *Betula* seedlings encroaching from the bog edge. *Myrica* is very common in this area associated with the numerous drains. There is one area with pools in the north-central part, which has similar vegetation with the addition of *Sphagnum cuspidatum* in the pools. The pools are mostly linear, suggesting tearing, with a NW/SE orientation. *Sphagnum imbricatum* and *S. fuscum* hummocks were seen but at low frequencies. *S. magellanicum* was also present but *Sphagnum capillifolium* was the commonest *Sphagnum* species. The western indicators *Racomitrium* and *Pleurozia purpurea* were present in small amounts. *Carex panicea* was recorded all over the site apart from the area with tear pools.

Along the western boundary there is a fringe of *Rhododendron ponticum* (PM3:12 to SW and PL6:15 to NW) behind the face bank. Mixed woodland occurs behind this fringe on the shores of Lough Forbes. To the north *Pinus sylvestris* woodland occurs and there is a copse of mixed woodland on the high bog at the NE side - Derreen Wood (PL6:18 to NE). All these woods are shown on the 1840s map.

The drains in the cut-away area to the east are dominated by *Ulex, Molinia* and *Juncus effusus*.

To the south beyond Drain mD and the bog proper there are areas of *Calluna* dominated vegetation with *Molinia* channels leading down to the Camlin River (similar to those on Fisherstown). The drain itself is lined with *Betula* scrub and *Pteridium*.

6.2 DETAILED VEGETATION OF THE HIGH BOG (Vegetation Map)

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

The *Calluna* dominated face bank occurs along the southern and western sides of the site. To the south and west *Molinia* is encroaching into the face bank and there is an amount of *Pleurozium schreberi, Aulacomnium palustre, Polytrichum alpestre* and *Dicranum scoparium* throughout. This suggests that there may be some enrichment. In addition and because the slope to the bog edge is gradual the *Sphagnum* cover is higher than is usually seen in this complex. At parts of the southern margin there is a gentle rise up to the face bank from the high bog. Where this complex is seen to the W of Derreen Wood there is *Pteridium, Myrica* and *Molinia* throughout.

Complex 3/6

This complex is seen to the N of the site between Drains bK and bM and is dominated by *C. panicea* with a reduced *Narthecium* cover. The bog further N has been burnt - burnt pine stumps - and the fire may have extended S resulting in high *C. panicea* cover. The ground is hard and dry.

Complex 2/6

This is a small complex on the steep slopes associated with the peat cutting on the eastern side of the bog (Slope 6). It is dominated by *Trichophorum* and *Narthecium* with a very low *Sphagnum* cover (5%) (PM3:22 and 26).

Complex 9+*Myrica*+Pines (+My+Pines)
The vegetation between the complex of Drains bN is dominated by *Eriophorum vaginatum* with many *Pinus sylvestris* and *Betula* and burnt *Pinus* trees (PL6:23 to W). Along the drains and in stands between them *Myrica* is very common. The *Sphagnum* cover was moderate in some parts of this complex. *Rhododendron* is also encroaching along the drains from the woodland to the north. *Campylopus atrovirens* was also noted in this area.

Sub-Marginal Complex
Complex 6
This complex covers a small area along the bog edge in an area of active peat cutting at the SE corner; in an area close to the NW corner and on the flat area approaching Drain bJ from the south. These areas are dominated by *Narthecium* with a high abundance of *Calluna* with algal hollows. The total *Sphagnum* cover is low (10%) and the acrotelm is variable. *Sphagnum fuscum* and *S. subnitens* were noted. Between drains bJ and bK there is a lot *of Carex panicea* and poor *Sphagnum* cover.

Close to the W end of Drain bB there is a very small area of this complex with a slightly higher *Sphagnum* cover (6/10).

On the slope into Drain bJ *R. alba* becomes quite frequent in this complex (6/4).

Sub-Central Complexes
Complex 10$^-$
A slightly drier version of 10 denoted as 10$^-$ occurs in the SE corner, W of Drain bC. The *Calluna* is tall (40cm) but the *Sphagnum* cover is still good but there are few pools. Another area of this complex can be seen in the NE of the site to the W of Derreen Wood.

Complex 10/6
This complex type covers most a large part of the central section of the site. The occurrence of *Narthecium* hollows is high (20-25%) and the *Sphagnum* cover is intermediate (30%). In many areas *Pinus* and *Betula* are encroaching into this complex. To the NW there is evidence of mounds possibly used for game shooting. These support *Dicranum, Hypnum, Aulacomnium palustre, Pleurozium schreberi, Hylocomium splendens* and the epiphytic cover on the tall *Calluna* is 3 (2).

Areas with a higher *Cladonia* cover (70%) are indicated by 10/6+Cl. Species recorded include *C. portentosa, Cladonia subservicornis* var. *verticillata* , *C. crispata* and *C. uncialis*. The *Sphagnum* cover tends to be lower in areas with a higher *Cladonia* cover.

Approaching the SW end of Drain bB the frequency of algal hollows, *Narthecium* and *Trichophorum* increases in this complex.

At the west of the site in the vicinity of Drain bG this complex has an higher abundance of *R. alba* hollows.

Complex 10/6 with Tear Pools.
This area is confined to the northern-central section. The *Sphagnum* cover is intermediate (35%) but there are 20% *Sphagnum cuspidatum* pools (some with *Cladipodiella fluitans*) (PL6:19). These pools are mainly linear with a NW/SE orientation and are shallow. Many are algal (10%) or bare.

6.2.2 Flushes
Complex 10 and Flush Z.
This is a small area to the south of the site in the vicinity of Drain bB. There are some tear pools with *Sphagnum cuspidatum* with *Sphagnum magellanicum* lawns at the edges. The total *Sphagnum* cover is high (60%) with some taller hummocks with mats of *Vaccinium oxycoccus* and *Pleurozium schreberi*. There are no signs of burning and the lichen cover is moderate. This area may be associated with Flush Z which appears to follow the line of an old drain at the SE side. Within this area there are patches of *Betula* scrub (1.5m) with *Empetrum nigrum, Eriophorum vaginatum, Hypnum jutlandicum, Aulacomnium palustre, Vaccinium myrtillus, V. oxycoccus* and *Andromeda polifolia*.

Flush Y

This is a linear flush to the N of the site NW of Derreen Wood. In the past the woodland used to extend along the flush (as shown on the 1840s map). The outfall from the flush has been described under Drain bM. At the junction drains bK and bM and extending along the NW side of Derreen Wood, there is an area dominated by *Pteridium* and *Molinia* and is surrounded by abundant tall *Myrica* (1.5m) stands. Between both is an area dominated by *Myrica, Calluna* and *Carex panicea* (PM3: 20)

7. BOG TYPE

This bog has been classified as a Broad Floodplain bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes (See Slopes Map)

Slope 1 At the southern edge of the site the slope is gradual towards Drain bD, 0.5m over 100m through Complex 1. Drain mD is beyond with scrub and the floodplain of the Camlin River beyond.

Slope 2 To the western side to the *Rhododendron* dominated edge the slope is gradual, 1m over 250m through Complex 10/6 + *Cladonia*

Slope 3 A gentle slope to the NNW towards Drain bH is 1.5m over 100m.

Slope 4 There is a gradual slope of 3m over 250m northwards from Drain bF to Drain bJ through Complex 10/6 +TP, after which the slope steepens towards Drains bK and bM, (PM3:19 from bJ to bF and PM3:21 from N to high bog at S).

Slope 5 From Drain bJ northwards into bM the slope is steep 2.5m over 30m.

Slope 6 From Drain bF south-eastward into active cut-away the slope is 3m over 50m (PM3:22 to SE). The edges of the bog undulate in this area and the slope varies and in places is 2m over 30m with cracking and slumping (PM3:26 to NNE).

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

The Camlin River to the S, Lough Forbes to the W and Castle Forbes Estate to the N form the boundaries along three sides of the bog so that peat exploitation is mainly confined to the easily accessible eastern side. Here peat cutting is active and has been extensive in this area (PM3:22 looking SE from Drain bF through Complex 6/2). The face bank edge varies from 3m to 2m in this area with severe cracking in places.

8.2.2 Forestry

There are mature mixed woodlands along the west (Corlehan Wood), north-west (Clonguish Wood), north-east (Ballacarrigan Wood) and on the high bog to the to the east (Derreen Wood) of the site. These are all shown on the 1840s map. They are now being invaded by *Rhododendron* which is also encroaching onto the bog margins in places (PM3:12 and 13). In addition *Pinus sylvestris* saplings are also invading particularly on the northern section of the site (PM3: 20).

Recent coniferous forestry has also been planted on the old cut-away to the east of the site.

8.2.3 Fire History

There is evidence of fire in the northern section of the site where numerous burnt pine trees may be seen (PL6:23 to W). Large parts of the S section of the bog have a high % cover of *Cladonia* suggesting these areas have escaped recent burning. There is less *Cladonia* cover to the SE of the site suggesting that fire has been an occurrence in the past.

8.2.4 Dumping

Dumping, including dead animals, is carried out in places in the cut-away to the SE and there are many rats in evidence.

8.2.5 Agricultural Improvements

Deep drains have been excavated to the SE of the site in an attempt to reclaim fields for grazing during the summer months.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. To the N of the site old drains have caused considerable drying out and some subsidence of the bog surface.

2. A till mound is seen to the NE of the site. A broadleaved woodland grows on this and Flush Y (now drained) is associated with the mineral rich water flowing from the mound (EC 235 µS/cm).

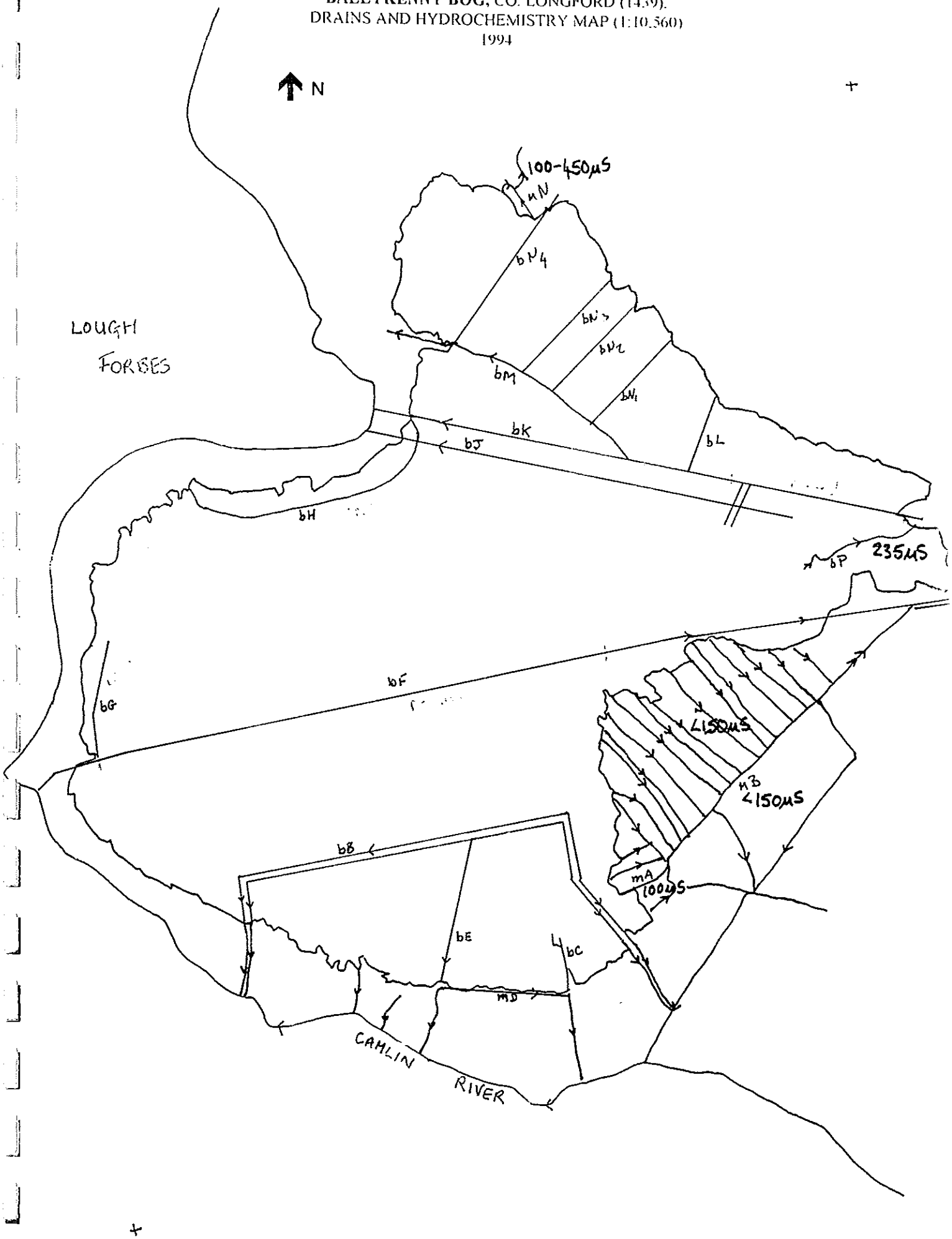
3. The effect of peat cutting is significant on the E side of the site where some steep marginal slopes are seen.

4. *Rhododendron* is encroaching onto the site in places. It is seen growing all along the W edge.

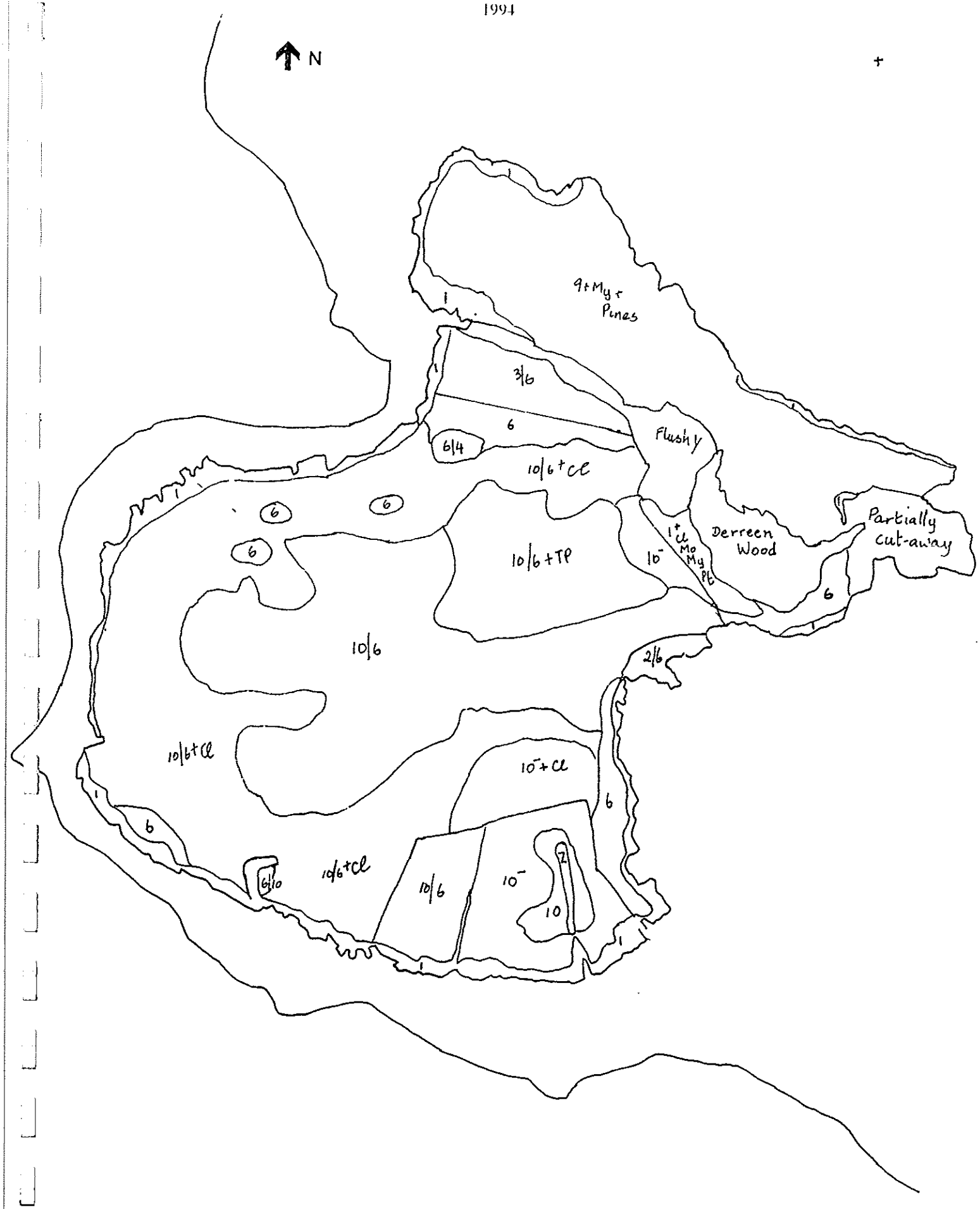
Lara Kelly
Malcolm Doak
Marie Dromey

Raised Bog Restoration Project (1995).

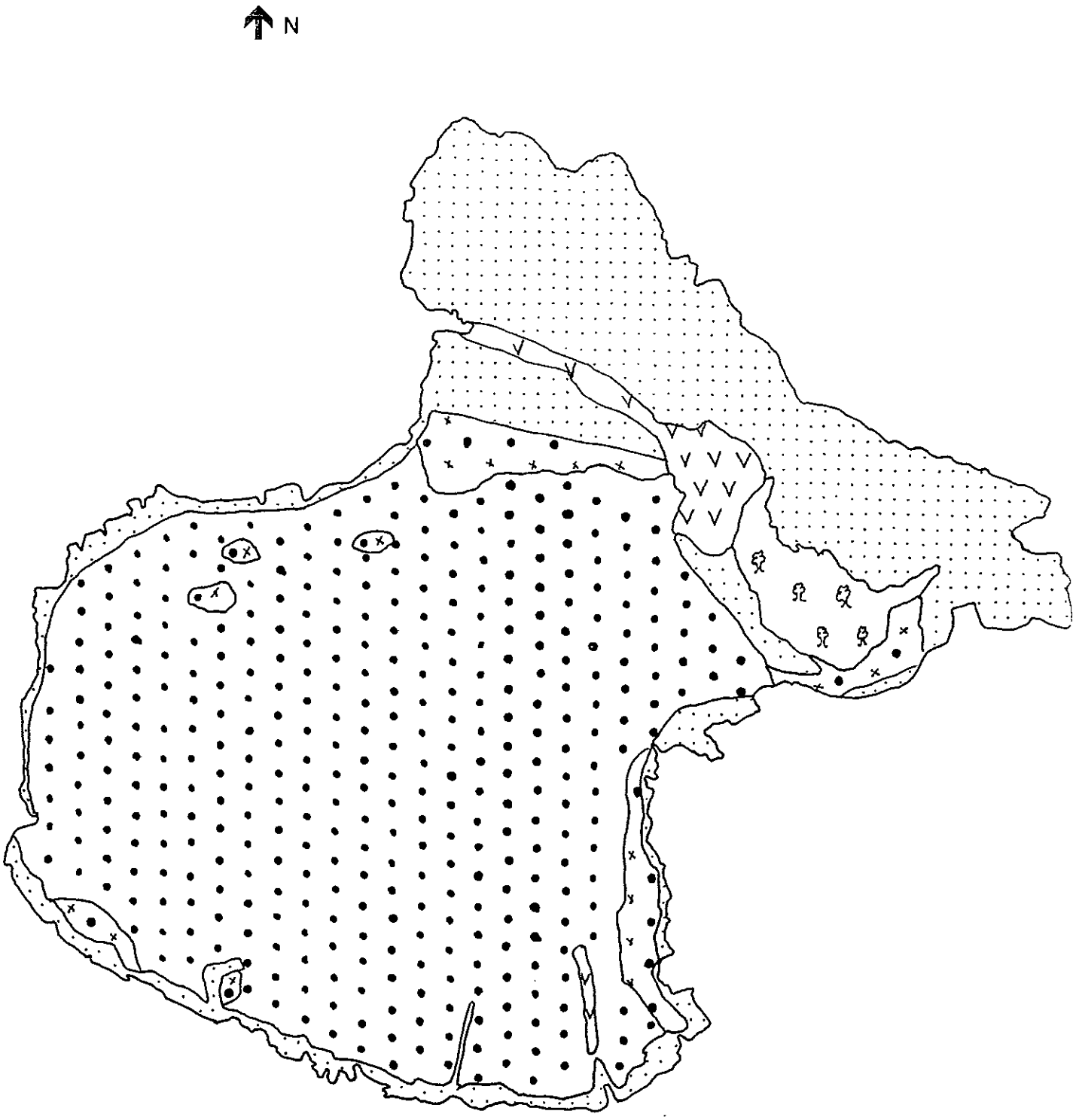
BALLYKENNY BOG, CO. LONGFORD (1439).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994



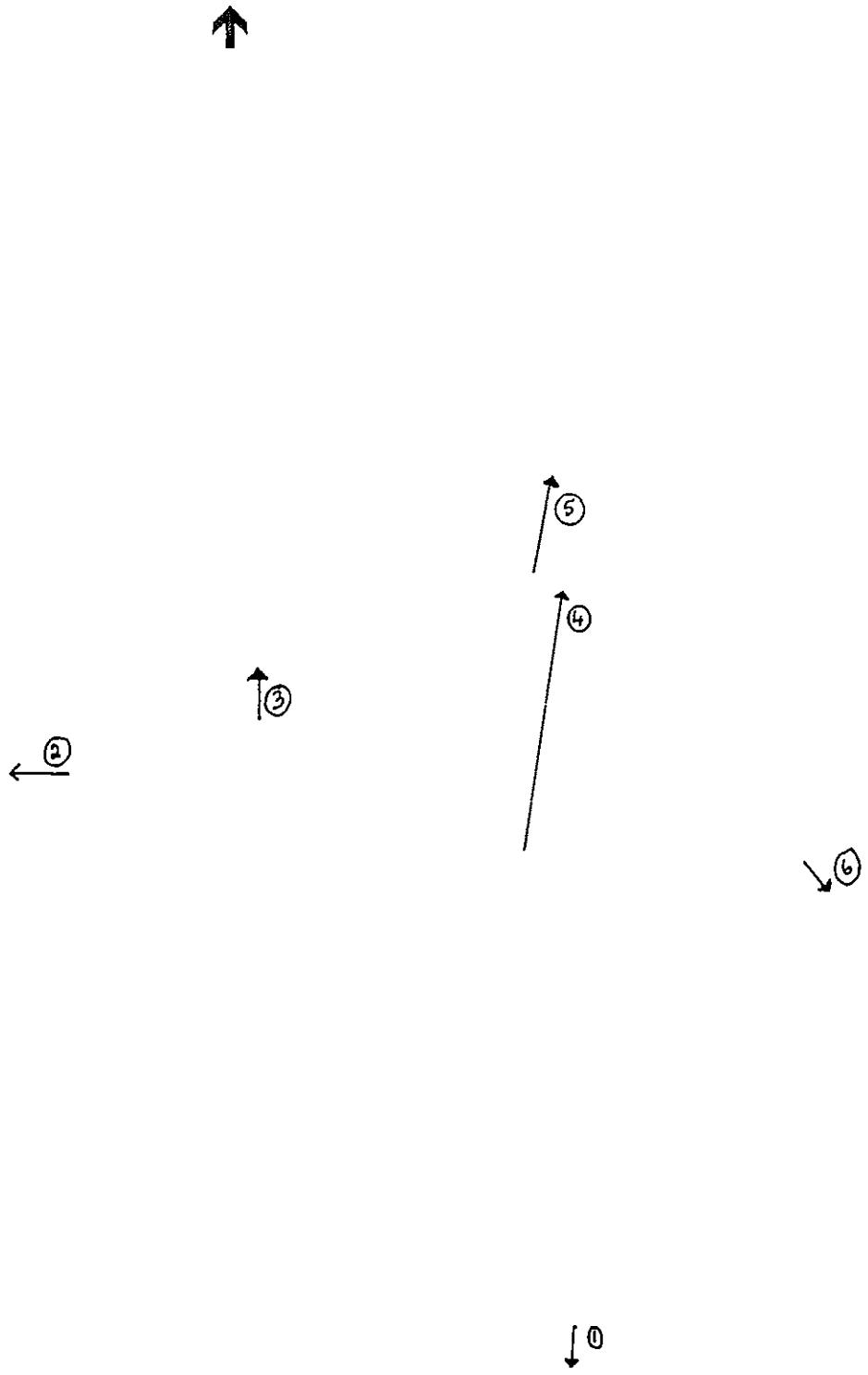
BALLYKENNY BOG, CO. LONGFORD (1439).
VEGETATION MAP (1:10,560)
1994



BALLYKENNY BOG, CO. LONGFORD (1439).
ECOTOPE MAP (1:10,560)
1994



BALLYKENNY BOG, CO. LONGFORD (1439).
SLOPES MAP (1:10,560)
1994



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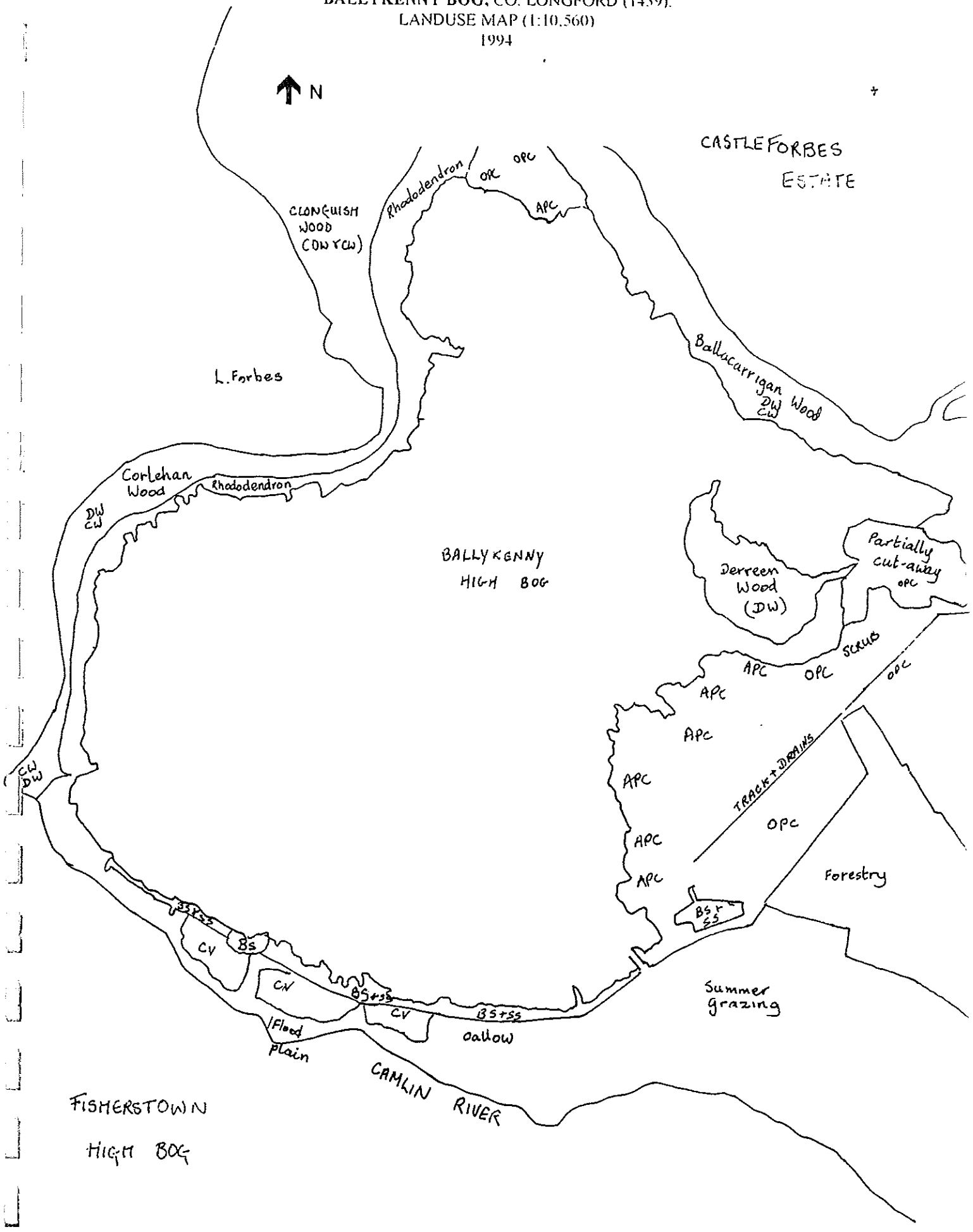
LANDUSE MAP (1:10,560)
1994



BALLYNAFAGH BOG, CO. KILDARE

1. SUMMARY OF SITE DETAILS

NHA No.	391	1/2 Sheet:	16
Grid Ref:	N 81 28	6" Sheet:	KE 13
GSI Aerial Photo:	N 463	1:25,000 Sheet:	26/21 NE, 26/23 SE
NHA Photos:		Area (ha):	67 (High Bog)

Date(s) of Visit:	11/3/94 & 16/5/94	(Ecologists)
	28/4/94 & 29/4/1994	(Geohydrologist)

Townlands: Ballynafagh and Downings North.

2. INTRODUCTION

2.1 BACKGROUND

Ballynafagh bog was visited in 1983 during the National Raised Bog Survey undertaken by the Forest and Wildlife Service (O'Connell and Mooney, 1983). It was described as a site which had been extensively modified but which still possessed a small wet central area and had some conservation value. Ballynafagh was classified as a Bii site and thus considered to be of moderate quality and of local importance.

Four Co. Kildare raised bogs were evaluated as to their conservation value or potential by Goodwillie in 1984 for Kildare Co. Council. They were Mouds, Carbury, Prosperous and Ballina; Ballynafagh was also discussed. The Carbury and Prosperous sites had both been drained and thus had little conservation potential. Ballina bog and Mouds bog were described as having the best conservation potential, however private exploitation of the former has reduced its value. Mouds bog was considered to have suffered extensive marginal peat cutting which was in many cases still active. This would cause problems as purchase of the site would be complicated. Ballynafagh bog was to be the 'fall-back' site if the conservation of Ballina bog failed. Ballynafagh was described as being in much better condition than either Carbury or Prosperous bogs as it had some pools although they were not well developed. The Robertstown Conservation Committee expressed an interest at the time in the conservation of the bog as a local amenity.

Cross (1986), in a further report, described Ballynafagh as a considerably modified site. However its conservation would ensure that the east-west variation of raised bogs would be preserved. Furthermore it is close to amenities such as the Grand Canal, Lullymore Peatland Research Station and Pollardstown fen and could form part of a network of educational and recreational facilities.

In 1987, the vegetation and hydrology of Ballynafagh was investigated during a six month period (Hammond *et al.*, 1989). The vegetation of the site was described and two hydrological transects were installed.

Cross (1990) stated that extensive areas of raised bog once existed in Co. Kildare but as they were some of the first bogs to be exploited by Bord na Mona, only remnants now remain. However these remnants, of which Ballynafagh has the highest conservation potential, are the most easterly examples of raised bogs remaining in the country. Therefore Ballynafagh was included in the list of sites to form part of a raised bog nature reserve network and was investigated in this survey.

2.2 LOCATION AND ACCESS

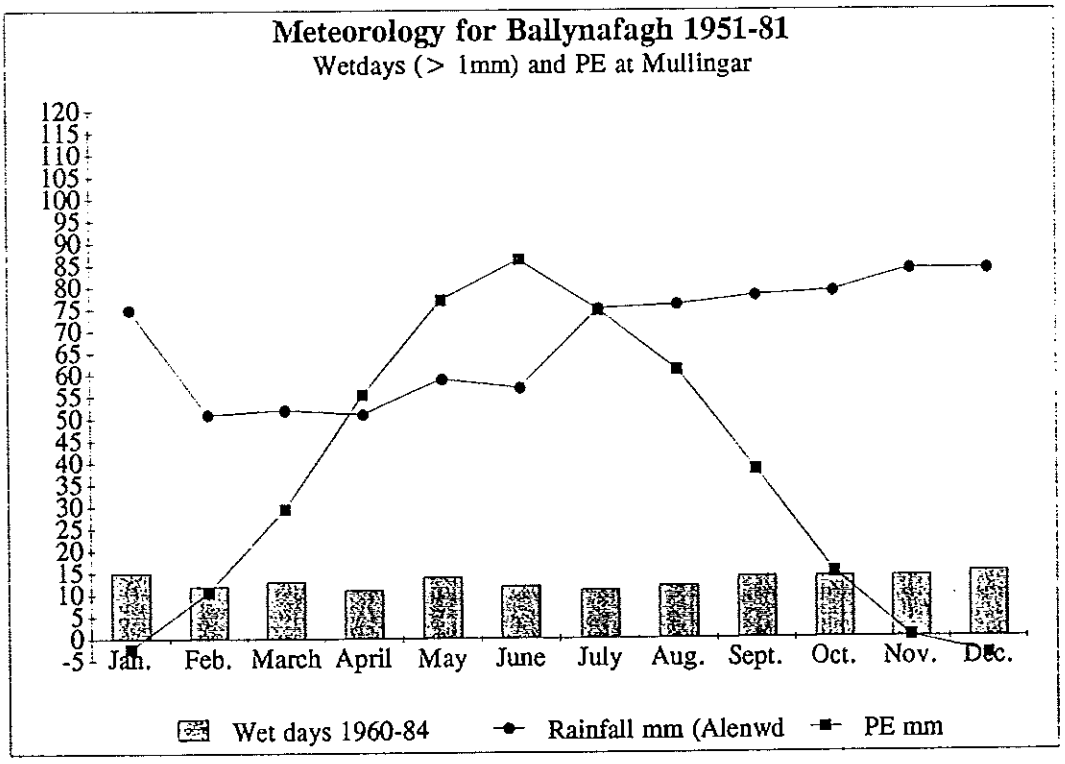
This bog is located approximately 3 km NNW of the town of Prosperous, Co. Kildare.

The site may be entered by road at the NE, S and W of the bog. The minor road runs east-west along the entire northern extent of the bog. The main Clane to Allenwood road runs east/west by the southern side of the site.

3. METEOROLOGY

No meteorological measurements have been made on Ballynafagh bog. Rainfall data from the nearby Allenwood weather station for the years 1951-80 indicate that the area receives approximately 793mm of precipitation annually (See Fig. 4). The nearest 'midland' synoptic station at Mullingar suggests that the site could receive up to 218 rain days annually.

Figure 4:



Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that actual evapotranspiration (AE) from Ballynafagh bog is greater than PE at a synoptic station. Nearest synoptic stations are Dublin Airport, Mullingar and Birr. PE at Mullingar of 442mm/yr (1951-81) is the best indicator for PE at Ballynafagh, since the bog is a midland site away from the coast (Mr E. Daly *pers. comm.*).

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore 351 mm/yr.

Meteorological data for Ballynafagh Bog (1951-1981) are summarised below:

Rainfall (P)	793mm/yr
Actual Evapotranspiration, (AE)	442mm/yr
Potential recharge, (PR)	351mm/yr
Raindays > 0.2 mm (annual {1951-1980})	218 days
Wetdays > 1mm (annual {1960-1984})	159 days

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

Ballynafagh is a raised bog dome which was once part of a series of raised bogs, that coalesced to form one large sweeping bog. The 1840s GSI maps suggest that this larger bog occupied the lower areas of the Allenwood and Prosperous district bounded by higher areas of land. The maximum 1840 confines for the large bog were at the 96m O.D. level.

In plan, the site reaches a maximum length of 1500m in a SW-NE direction. It is thinnest in a north-south direction where it has an average width of 700m. Cutting in the SW has caused a 250m x 550m lobe of bog to become detached from the main bog.

Cut-over and raised peat bog covers much of the low lying ground north of Prosperous and Blackwood. Ballynafagh bog has a typical watchglass topography; it has a relatively steep gradient around the margins which become gentler moving towards the centre, where the bog has its highest point at 92mOD. The marginal slope has been increased in many areas as a result of subsidence caused by drainage associated with cutting.

4.2 TOPOGRAPHY OF THE SURROUNDING AREAS

The site is bounded to the north-east by higher land at a maximum height of 113m O.D.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by dark grey muddy fossiliferous Carboniferous limestones (shown as ABL, on map), interbedded with thin calcareous shales. A low angle reverse fault runs SW/NE directly under the bog, causing the NW area of the bog to be underlain by Waulsortian Carboniferous limestones (fossiliferous mudmounds) which are in part dolomitised

The muddy fossiliferous limestones generally have a low permeability and are classed as a poor aquifer. The Waulsortian limestone also has a low permeability, although dolomitisation and faulting can increase permeability significantly.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

Some subsoils data were available for the Ballynafagh bog. These included 1840's geology maps, GSI 1970's TFA reconnaissance maps and a National Soil Survey report for Co Kildare.

Geology of Inorganic Subsoils

The subsoil geology of this bog and surrounding area is dominated by two types of Quaternary glacial tills. Recent fieldwork indicates that sections in drains in the cut-away areas at the outer limits of the bog are underlain by poorly sorted clayey tills with relatively large sub-angular clasts composed of limestone, sandstone and quartzite. These tills may originate from the Chair of

Kildare/Slieve Bloom region since there is a wide assortment of metamorphic clasts within the clay matrix limestone till. A second more permeable till is found in the higher ground peripheral to the bog, where there are several local extraction pits. It appears that large limestone clasts were extracted from an overall stony till with a silt matrix. These areas of till lack surface drains suggesting that the subsoils here are relatively free draining. The Kildare soil survey indicates that these higher areas are composed of limestone till and gravels, mostly with till at surface and gravels at depth.

It is believed that Ballynafagh bog is predominantly underlain by the clay rich tills. The high proportion of fines in the tills suggest that it has a low permeability. To date there is no evidence to suggest that any part of the bog is underlain by lake clays.

Peat
Geological maps produced in the 1840s show that peat once covered all the low lying ground below the 98m OD contour. Presently, the only area of intact peat falls within the 100m O.D. (300 ft) contour line on the 6" OS maps since cutting has removed peat.

The physical properties of the peat are variable across the bog. Peat close to the margins, adjacent to bog drains and in the cut-over area is generally denser and more compact than the peat found further towards the bog centre. Slope failure and occasional small macropores have been noted in the 2-3m high face banks along the south eastern margin. These features are secondary features in the peat which have developed in response to cutting.

Hammond *et al.* (1989) show that the Ballynafagh bog stratigraphy has three layers. There is an ombrotrophic layer which has two tiers - an upper 2 metres of wet, strongly acid poorly humified *Sphagnum* peat, overlays a layer of humified *Sphagnum* peat with remains of cyperaceous debris. The ombrotrophic peat overlays a transition layer with a mixture of plant remains typical of both ombrotrophic and more minerotrophic habitats. This in turn is underlain by fen or woody peat. Hydraulic conductivities in the upper catotelm (52-72cm from surface) were generally very low at <0.03m/day. It has been noted by Hammond *et al.* (*op. cit.*) that this bog is particularly dry with much *Calluna*.

Soils
The soil map of Kildare indicates that the soil adjacent to the SE of the bog is mainly the Allenwood complex series, comprised of peaty gleys and shallow organic soils. Other soils nearby are the Allen series peats, formerly raised bog but now existing as cut-over with drains. Some of these peats were found to be underlain by shell marl.

5.1.3 Depth to Bedrock
Exploratory mineral boreholes directly N and NE of the bog show that depth to bedrock is a maximum of 11m in the cut-away, and 28m in the higher till area to the NE of the bog. Hammond *et al.* (*op. cit.*) show that peat depths at Ballynafagh vary from 4.15m to 7.5m.

5.2 HYDROLOGY (See Drains Map)

5.2.1 High Bog Hydrology

North and north-west
At the NE side of the bog there are three drains which extend in a triangle onto the high bog. Drains bC, bD and bE are 0.25m wide with significant flow to the NE. They are over-hung by *Calluna* dominated face bank.

Four new drains, approximately 2m deep, are seen on the northern side of the bog. Two of these are short (bA1 and bA2) and two extend towards the wettest section of the site, bA3 (PL3:1 toward E and PL3:2 toward S) and bA4 (PL3:4 toward south). They are approximately 1m deep by 0.5-1m wide with water flowing to the N. These drains are all quite recent with little or no *Sphagnum* growth.

A N/S double drain (Drains bB1 and bB2, 10m apart) has also been inserted in connection with the forestry plantation on the west of the site. They are both approximately 0.5m wide by 0.25m deep. They extend almost across the whole high bog where they meet a further double drain at right angles leading to the western facebank (bB3 and bB4). The drains associated with the forestry had a high water level at the time of the survey (15 -20cm) and are partly infilled with *Sphagnum cuspidatum*. The face bank complex grows along the edges of these drains. The N/S part of these drains had no flow but where they turn and run E/W, bB4 has flow to the W.

South and south-east
A number of new drains, bH1-bH4, have been inserted in connection with peat cutting and tree planting on the south-eastern margin. They do not extend into the centre of the site (PL3:13 toward NNW shows drains and the vegetation boundary between complexes 10 and 6). Drains bH1 and bH2 are 1m deep by 0.5m wide and are bare of vegetation with flow to the SE. Drains bH3 and bH4 are of similar size with some flow to the south. The latter two may have been dug by hand. There is a relatively strong flow from all these drains to the main southern tributary of the Slate River, 200m away.

East and north-east
There are a number of short drains running into the high bog associated with turf banks. Sections of these drains which are in the cut-away have been colonised by *Typha latifolia* (EC 124 µS/cm). At the north-eastern corner of the site there are a series of drains, bG1-bG5, which are have flow to the E. Drain bG1 which runs E/W is 1m deep by 0.6m wide with significant flow to the E.

Centre
Drain bJ is old and not very well defined in the field. It is aligned NW/SE and may link with Drain bC and bD to the E. The drain is 0.75m wide with 20cm of water. It is infilled with *S. cuspidatum, S. papillosum, R. alba, Drosera anglica, E. angustifolium, Calluna, Narthecium, Andromeda, E. tetralix* and *Cladopodiella fluitans*. No flow was seen in the mid section. This drain is probably related to the subsidence in the centre section of this site.

5.2.2 Bog Margin Hydrology

The principal drains have been labelled on the Drains Map and are discussed separately below.

Streams N & M.
The hydrology of the bog margins is dominated by two tributaries (N and M) of the Slate river. N, lies directly to the south of the bog. M lies to the north. Both tributaries flow westward to the Slate river/Grand Canal. The southern stream is a maximum 300m south of the bog where it is deep and flows all year round. It had an average EC of 530µS/cm. The northern tributary was often dry in places (April 1994). It originates in the bog at K, and runs alongside the northern road on the cut-away. It has an EC of about 270µS/cm.

North
Drains mA1-4: These drains originate on the high bog (bA1-bA4) and flow north into the stream, M. For every bA drain there are two to three minor drains on the cut-away. There is relatively little flow from the bA drains to the associated cut-away drains, mAs. The mAs show iron iridescence nearer to the road. They are < 2m deep in peat, where water is about 0.5m deep.

Small older mP drains flow south to the stream M, from Coillte forestry. Water at the surface is iridescent. They are 1.5m deep in peat; water is at a depth of 0.35m.

The mF drains are recent and are relatively deep at 2.5m in peat, originating from the forestry plantation on the bog. Water is 0.7m deep.

North East
Drains mG consist of four drains originating on the high bog (bG1-bG4). They are peat lined and contain variable depths of water ranging from 0.1m to 0.4m. They are between 0.5m and 1m wide

and show some algae growth and iron iridescence on their surface. Drains mG flow NE to a larger drain (mV). Drain mV flows south along the cut-away/mineral soil boundary to the bridge at Q, joining the main southern stream, N. Drain mV, sitting entirely in cut-away is 2.5m deep and 1m wide. It cuts into clay limestone till at 1.65m b.s. It shows relatively high flow.

South East
There are many shallow and narrow drains in this area. Maximum depth is 2m, where water is shallow in peat. Many of the drains are overgrown with *Ulex* and *Sphagnum*. The oldest cut-away sections for this bog are found in the south east.

South
Drains mH1-4: These new deep drains originate in the high bog (bH1-bH4). There is extensive peat cutting here, both at the cut-away and onto high bog. These drains are often >3m deep with large amounts of water where they are found to cut into the tills underlying the peat. Flow is strong south to nearby stream, N. There is much facebank collapse.

Drains mJ: These drains are often 2m deep with water at 0.7m depth. They are found to often cut into the clay tills underlying the bog.

South West
There is a extensive marginal drain system (Z) in the old cut-away sections with relatively medium flows. Some of the drains are dry, all sit in peat.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Hydrochemistry Map)
Water flowing from the bog and the adjacent inorganic subsoil was sampled on the 28th April, 1994. There had been little rain over the previous four days. Water flowing from the bog had low ECs, typically less than 100 µS/cm. These values are similar to that of rainfall reflecting the largely inert nature of the peat. In contrast relatively high electrical conductivities (350-360µS/cm) were noted in drains mV, mA, mH and mJ, sited on/in inorganic subsoils of the cut-away margins. Generally water running off the high bog via face drains should not have EC values greater than 150-180µS/cm. It is believed therefore that groundwater is upwelling at these drains in the cut-away, where it mixes with water running off the bog before it moves onto the two streams N and M.

A consistent drop in EC was observed in mM along much of its course. This was believed to reflect the increasing contribution made by water flowing from the bog to the total discharge in the drain.

5.3.2 Laboratory Hydrochemistry
No samples were taken for analysis at the Coillte laboratory.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
Recharge to groundwater occurs in the higher areas of till, which are often underlain by sands and gravels. The lack of drainage indicates that a high proportion of recharge infiltrates to groundwater. Small rivers direct any surface-runoff S/SW to the Grand Canal.

It is probable that the groundwater table mirrors topography. Consequently underground flow occurs towards the low lying areas in the vicinity of the bog. Five springs are known to discharge groundwater within a 3 km radius of Ballynafagh at the 98mOD - 99mOD level.

The low permeability clay till underneath the bog helps largely isolate the bog at Ballynafagh from the regional hydrological regime, except around the margins. Most of the water drains at Ballynafagh bog direct their water to stream N.

Bog Regime
Five main sets of drains move water effectively off the high bog to the cut-away areas showing significant flow to the margins. They are bB; bA; bD bE bC; bG; bH. They serve all parts of the high bog except the S/SW area. Drains bD, bE, bC, and bB initiate at the centre of the bog. All the sets apart from bD bE bC are relatively new appearing since 1974. The original water-table of the bog has been lowered since peat adjacent to all these drains is compacted and subsided.

It is not known how much recharge percolates vertically downward into the underlying low permeability till, but previous work at Clara suggests it is no more than 5% of ER.

Inter-relationship
Most of the cut-away drains lie entirely in peat. Several of the cut-away drains lie directly in clay tills particularly at drains mV, mH, mJ and mF. The 1840s geology sheets show that these drains are situated in areas that were once at the very edge of the original bog/mineral soil boundary. Electrical conductivity measurements at the drains were at the relatively high 320-360µS/cm range. There were also shows of iron iridescence in all these drains. Generally water running off the high bog via face drains should not have EC values greater than 150-180µS/cm. It is believed therefore that groundwater is upwelling at these drains in the cut-away, where it mixes with water running off the bog before it moves onto the two streams N and M.

6. VEGETATION

6.1 VEGETATION SUMMARY

This is a relatively dry site which has suffered regular burning in the past. Drainage and peat cutting have been extensive and forestry has been planted on the high bog. Despite this there is still an area of approximately 4ha with permanent *Sphagnum cuspidatum* pools and *S. magellanicum* lawns. These may be tear pools due to their linear shape, however the inter-pool areas have a high *Sphagnum* cover (80%). In addition the main central vegetation complex still has a relatively high *Sphagnum* cover (55%). There are few large hummocks, possibly due to frequent burning and *Sphagnum imbricatum* and *S. fuscum* were not recorded. No epiphytic lichens were recorded on *Calluna* during the survey of this site.

The old cut-away areas around this site are mainly colonised by *Betula* and *Ulex*. The more active cut-aways have *Juncus effusus* and *Molinia* in the patches which have not been cut recently.

At the SW edge of the site close to the severed arm of the bog there is an area of enrichment in the cut-away close to the face bank edge. It is colonised by *Carex rostrata, Potentilla palustre, Sphagnum recurvum, Salix* sp. and *Eriophorum angustifolium.*

A large area on the west of the high bog at this site is afforested with *Pinus contorta* trees which are approximately 15 years old. The inner part of the plantation close to Drains bB is very wet under foot with a well developed *Sphagnum* layer. This consists mainly of *S. capillifolium* but with some *S. cuspidatum*. The rest of the plantation is more or less impenetrable and thus the *Sphagnum* cover and other under-storey vegetation could not be mapped with any accuracy.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The vegetation of the site is described below in terms of plant community complexes. These are illustrated on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

This is the typical vegetation complex associated with the dry facebank edges of the bog. It is dominated by *Calluna vulgaris* and *Hypnum jutlandicum*. There is little *Sphagnum* cover and thus there is no acrotelm layer. This complex is particularly well developed along the eastern of the bog with *Calluna* reaching heights of over 80cm in the NE and SE corners. *Betula* is encroaching on the SE corner into the face bank complex. In places along the northern edge *Calluna* reaches heights of over 50cm in this complex.

Complex 2

This is the complex where *Trichophorum cespitosum* is abundant (30%). It is seen on the SE edge of this site where the slope to the bog edge is significant. Once at the top of the slope the vegetation grades into Complex 10. The total *Sphagnum* cover is low (10%), consisting mainly S. *capillifolium* and there is generally no acrotelm layer.

Complex Recently Burnt (RB)

This area to the west of the site was burnt approximately 2-3 years ago (PL3:11). It is associated with the area where most extensive peat cutting has occurred. Bare peat accounts for 40% cover and *Calluna vulgaris* and *Erica tetralix* dominate (50%) with some *Eriophorum vaginatum* re-growth. There few *Sphagnum* species and thus there is no acrotelm layer. There is about 30% cover of *Campylopus introflexus*. Close to slopes 6 and 7 *Epilobium angustifolium, Polytrichum alpestre, Dryopteris* sp. and *Luzula* were noted on the high bog. *Salix* and *Betula* are also encroaching onto the bog surface in this area suggesting that it is rather dry. The occurrence of these species suggests that there is some increased nutrient availability. This is most probably due to frequent fire events. However the presence of these plant species may be related to a flush area, that is, there may have been a flush in this area in the past, which owing to peat cutting is now only a relict.

Complex 2/7

This occurs along the N edge of the site and close to the area which has been recently burnt. It is dominated by *Calluna* (typical hummocks 60% and *Calluna* approximately 50cm tall) with a high cover of *Trichophorum* (15%) and abundant *Eriophorum vaginatum*. The *Sphagnum* cover is higher than would be expected in this type of complex (15%), and consists mainly of *S. capillifolium* hummocks. This moderate *Sphagnum* cover is probably due to non-burning as the *Cladonia portentosa* cover is 45% in places. Due to the *Sphagnum* cover there are some localised areas of acrotelm but generally there is no acrotelm layer in this complex.

Complex 6/2

This is seen along the northern edge of the site close to the coniferous forestry on the high bog. It is dominated by *Narthecium* (20%) and *Trichophorum* (10%) with a low *Sphagnum* cover (5%). The typical hummock cover is high (60%) and there is no acrotelm.

Sub-Marginal Complex

Complex 6/7

This is dominated by *Narthecium*, *E. tetralix* and *Calluna* and is seen around all the edges of the site. The complex is degraded as it has suffered burning in the recent past (*Calluna* only 20cm high). The *Narthecium ossifragum* hollow cover is approximately 25% with 40% bare peat and 30% cover of disturbed community types and a low *Sphagnum* cover (8%). *Cladonia portentosa* cover is low and *C. subservicornis* var. *verticillata*, *C. floerkeana*, *C. furcata* and *Campylopus introflexus* were recorded indicating disturbance. On the southern side of the bog there are some localised patches of this complex which have a high *Sphagnum* cover (50%). East of Slope 8 there are some patches of

Ulex in this complex occurring on mounds which appear to have been made artificially. Other species recorded on these mounds were *Pleurozium schreberi*, *Hypnum* and *Dicranum*. There are some areas of this complex on the southern side of the site which were burnt about 3-4 years ago.

Sub-Central Complex
Complex 9/10
This is a transitional *Sphagnum* complex which covers most of the central section of the site. There is an abundant cover of *Eriophorum vaginatum* (50%) with approximately 40% *Sphagnum* cover, 10% *Narthecium* hollows and some *Rhynchospora alba* hollows (5%). The lichen cover (15-25%) consists mainly of *Cladonia portentosa* with some *C. cilliata* and *C. floerkeana*. Most of this area has obviously suffered burning in the past (*Calluna* 30-40cm in height) but close to the coniferous plantation on the high bog there are patches of this complex where the *Cladonia portentosa* cover reaches 50%. There are some drier patches where the *Eriophorum vaginatum* and *Sphagnum* cover is lower and the *Narthecium* hollow cover is increased. The acrotelm depth is variable. Where this complex extends toward the northern edge of the site it appears to be confined to sunken areas where water collects. There are occasional *Sphagnum cuspidatum* pools (2%) but these are not well developed.

Central Complex
Complex 10/15
This is the hummock/hollow scattered pool complex. It forms the wettest vegetation cover in a central area slightly to the east of the site and another smaller area close to the drains associated with the forestry to the west. *E. vaginatum* cover is 40%. The *Sphagnum* cover is high (80%) are there are some permanent *S. cuspidatum* pools (10%) and *S. magellanicum* lawns. The average water table height in the pools at the time of the survey was about 15cm and some are deep sided. However these pools are not very well developed. There are occasional larger hummocks with tall *Calluna vulgaris*. Both areas where this complex occurs appear to be slightly sunken (PL3:7 toward N shows wet area with pools, forestry and drain). There is a well developed acrotelm layer and some sections are very quaking.

7. BOG TYPE

This bog has been classified as a Basin bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes
Several slopes were estimated in the field and are described below (See Slopes Map).

Slope 1	At the NE edge of the bog the slope northwards towards the cut-away is 0.5m over 50m with cracking and slumping of the peat surface.
Slope 2	From the high bog at the centre of the N edge into an area of active cut-away the slope is steep at 0.5m over 20m.
Slope 3	Just W of slope 2, the topography towards the cut-away steepens to 0.75m over 15m with slopes also into from the E and W.
Slope 4	At the NW corner of the site the slope to the N into the cut-away in the vicinity of the coniferous forestry on the high bog is 0.75m over 20m.
Slope 5	At the W of the bog, S of the forestry and W into the area of extensive and active cut-away the slope of the bog surface is 0.75m over 40m. There is surface water run-off in this area.
Slope 6	In the same area slightly to the S, the slope to the NNW is 0.7m over 30m.
Slope 7	At the SW edge the slope south-eastwards into the cut-away is 0.55m over 20m.
Slope 8	On the southern edge of the site the slope into old cut-away is 0.25 over 20m.
Slope 9	At the eastern side of the southern edge the slope is 0.75m over 40m.

Slope 10 The slope from the high bog into the SE corner is 1m over 25m with cracking of the bog surface.

Slope 11 Along the eastern edge of the bog the slope is 1m over 40m, with a lot of cracking and surface water run off into cracks.

Slope 12 From the high bog into the NE corner the slope is 0.5 over 15m with extensive cracking and slumping.

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

North

Extensive peat cutting has been carried out along this edge, creating a large area of cut-away. Most of the facebank in this area is active with difco cutting up onto the high bog. In some areas the sods resulting from difco cutting have been abandoned on the high bog.

West

On this edge the forestry covers most of the facebank but those areas that remain are active and it appears from the aerial photography that it is here that most peat has been cut-away from the site.

South

The leg of high bog which was still attached to the main bog in the 1970s has now been severed due to further peat cutting (PL3:10). This area was not visited as it would not be included in any restoration plan for the site. Active turbary may be seen all along the southern edge. Along the southern edge very recent preparations for peat cutting were noted during the second visit to the site.

East

The southern section of this edge has been partly abandoned and supports mainly *Ulex* scrub, but the northern section is still active.

8.2.2 Forestry

Coniferous forestry, mainly of Scots pine (*Pinus sylvestris*) and Sitka spruce (*Picea sitchensis*) is present to the north of the site on cut-away peat (PL3:3 towards N shows forestry, road and cut-away). The trees in this plantation are approximately 20 years old. On the 1970s aerial photography the furrows for forestry may be seen where this forestry is now located. This is a Coillte Teo. plantation.

To the west of the site there is a large Lodgepole pine (*Pinus contorta*) plantation both on the cut-away and the high bog. This plantation is approximately 10-15 years old. Within the plantation on the high bog the surface is very wet and *Sphagnum* growth is good. This is a private forestry plantation.

Associated with one of the drains on the southern side of the bog there is a small *Picea sitchensis* plantation of approximately 5 rows of trees about 2 years old (PL3:12 toward south) and just south of the main Lodgepole pine plantation there is a small area of *Pinus contorta* also (PL3:8 toward south and PL3:9 toward N).

8.2.3 Fire History

The site has been burnt most recently on the western side beside the area of most extensive cutting. Burning has occurred in other places around the site at various intervals, most notably on the southern side. However most of the site has not been burnt very recently and the lichen (Cladonia portentosa) cover in the central area close to the forestry reaches 45%.

8.2.4 Dumping

There is some dumping to the W of the site and to the NE in the cut-away.

8.2.5 Agricultural Improvements

Low intensity livestock farming is practised on the higher land surrounding the bog. Rape Seed is also grown here. The more poorly drained areas adjacent to the cut-over bog are used as poor pasture or have developed into scrubland.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1 The central wet vegetation complexes (10/15) on the high bog are related to subsidence which has probably been caused by drainage. Deep drains inserted beside the forestry on the high bog have caused compaction and subsidence of the peat and water now ponds in the area allowing a good *Sphagnum* layer to develop. The eastern central area is also slightly depressed and this is probably due to marginal drainage. This process may be explained in the following way: It is thought that the centre of the bog had a high water content (95% water) before the bB drains were placed in the centre of the high bog. The peripheral areas of the bog would have had a lower water content of approximately 60/70% water. When the drains were installed a higher water loss would have occurred in the centre of the bog and a lower rate in the periphery. Such a scenario may have led to subsidence and subsequent water ponding. This may be termed secondary pool development.

2 The vegetation complexes which are seen at the edge of the site are related to slopes caused by drainage and increased water loss. The boundary between vegetation complexes 6 and 10 appears to be associated with the crest of a slope. It is believed that acrotelm cannot develop on relatively steep slopes and hence complex 6 develops with only a poor *Sphagnum* layer.

3 Burning on this high bog has destroyed the acrotelm layer and the vegetation cover. This has effected the hydrological regime as water run-off is increased from the high bog. This has a negative effect on vegetation re-growth. This situation has occurred at the western side of the site and to a lesser extent along the southern edge.

4 A relative lack of permanent pools on the high bog may be linked to the low precipitation experienced by this easterly site. Evapotranspiration exceeds rainfall for longer periods of time here than it does at sites in the Midlands and the West. *Sphagnum cuspidatum* which appears to be unable to survive long periods of drought and cannot survive water tables below -10cm for longer than one month (Kelly, 1993). Therefore conditions over most of this site, due to drainage and low precipitation, are sub-optimal for its growth. Similarly the lack of *S. imbricatum*, which was only recorded in one place at this site, may be linked to low precipitation (Stoneman et al., 1993) but is probably also related to drainage disturbance and fire damage.

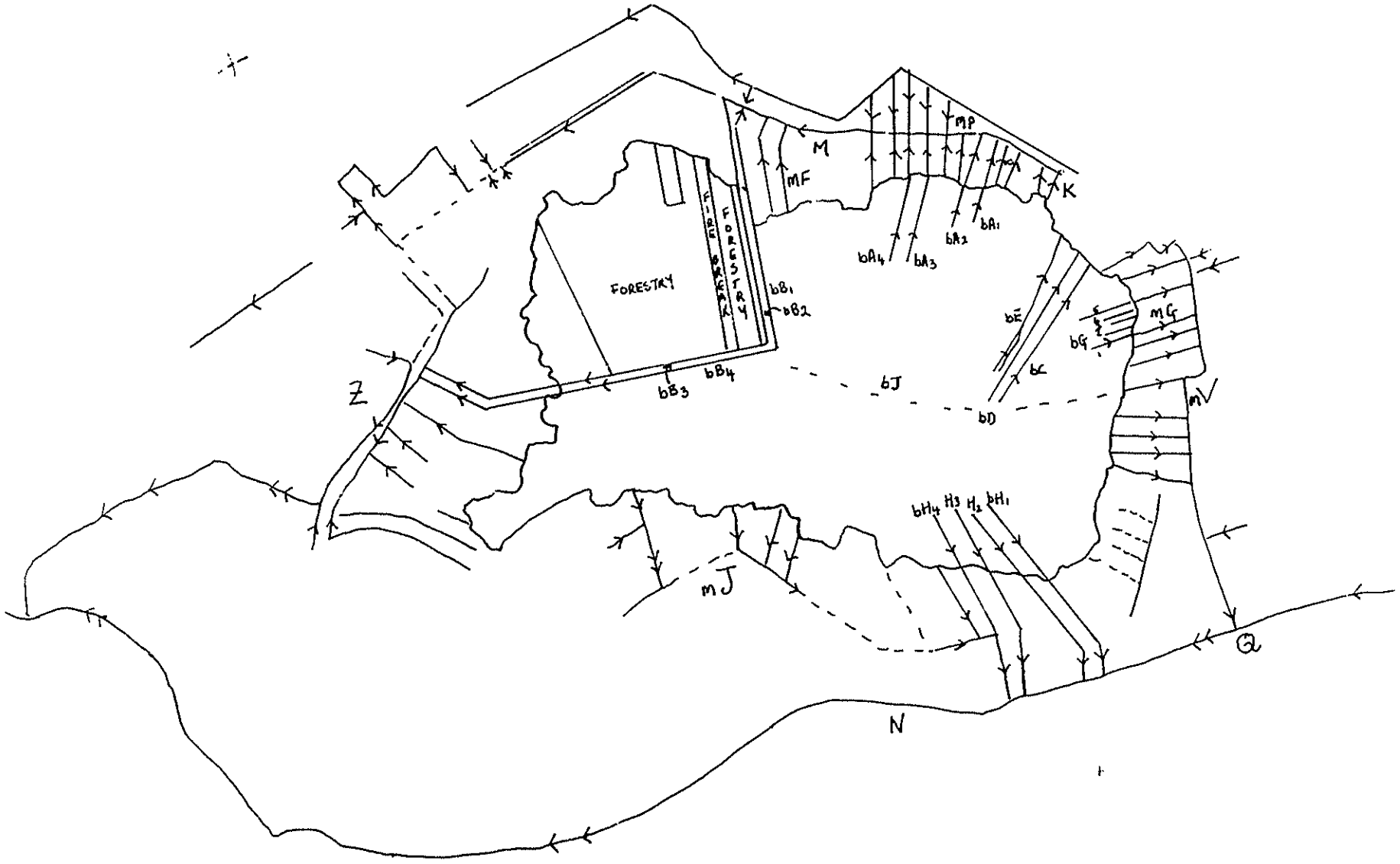
5 The low maritime influence on this site related to distance from the sea and the prevailing wind direction means that species which are used as western indicators are absent from this site. Species such as *Carex panicea, Racomitrium lanuginosum* and *Pleurozia purpurea* are not seen.

6 At the south-western side of the site there is a small wet area of vegetation which indicates mineral enrichment. This is probably related to peat mineralisation of the surrounding old peat banks but there may also be a very dilute ground water influence in this area.

7 The western side of the high bog which is afforested is wet with a good *Sphagnum* layer close to the Drains bB. This area may present possibilities for extending the central wet complex of the high bog if the trees were removed. The wetness of this area and the resulting *Sphagnum* growth may also be resulted to subsidence and water ponding caused by Drains bB.

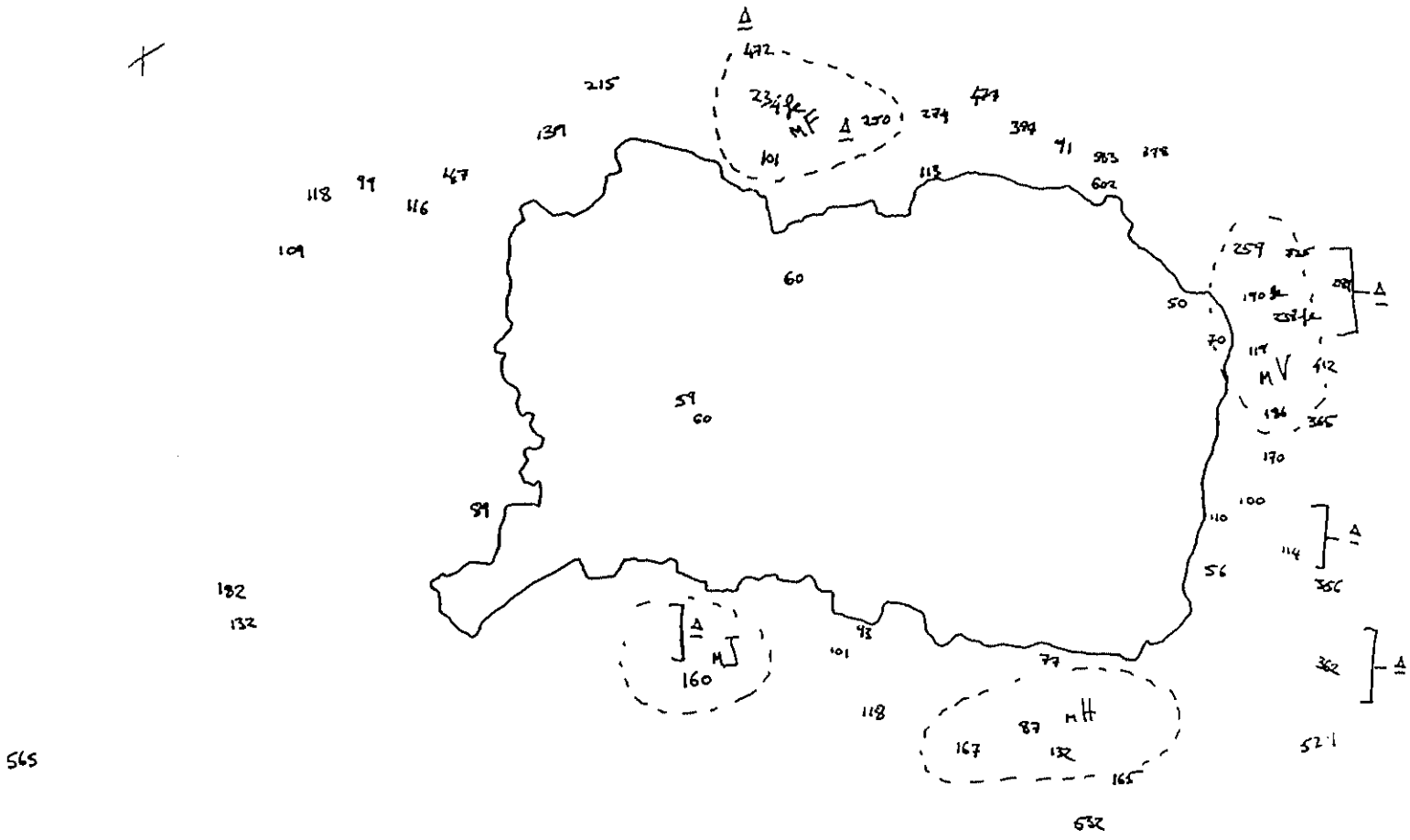
Lara Kelly
Malcolm Doak
Marie Dromey

Raised Bog Restoration Project (1995).



BALLYNAFAGH BOG, CO. KILDARE (391).
DRAINS MAP (1:10,560)
1994

N



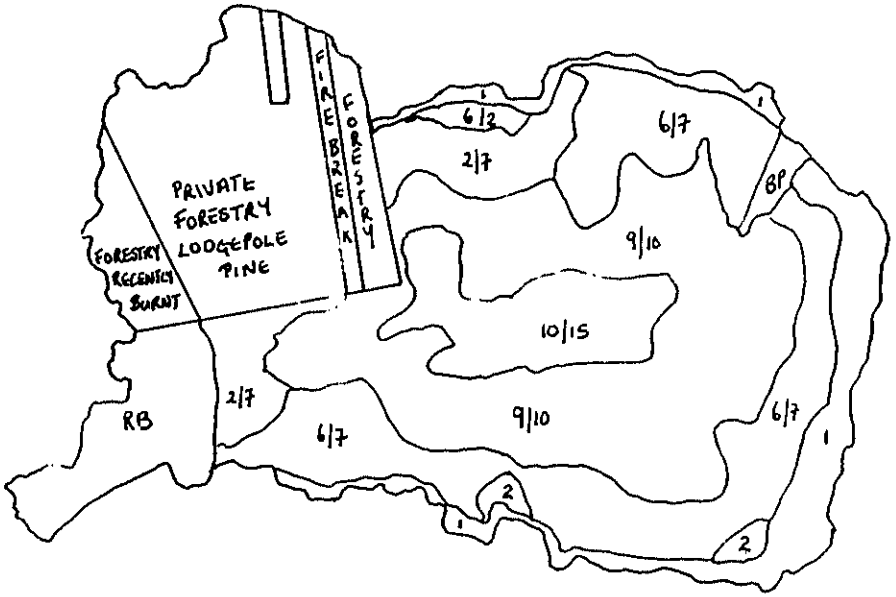
BALLYNAFAGH BOG, CO. KILDARE (391).
HYDROCHEMISTRY MAP (1:10.560)
1994

UPWELLING ZONES OF GROUNDWATER

Δ EXPOSURES OF TILL

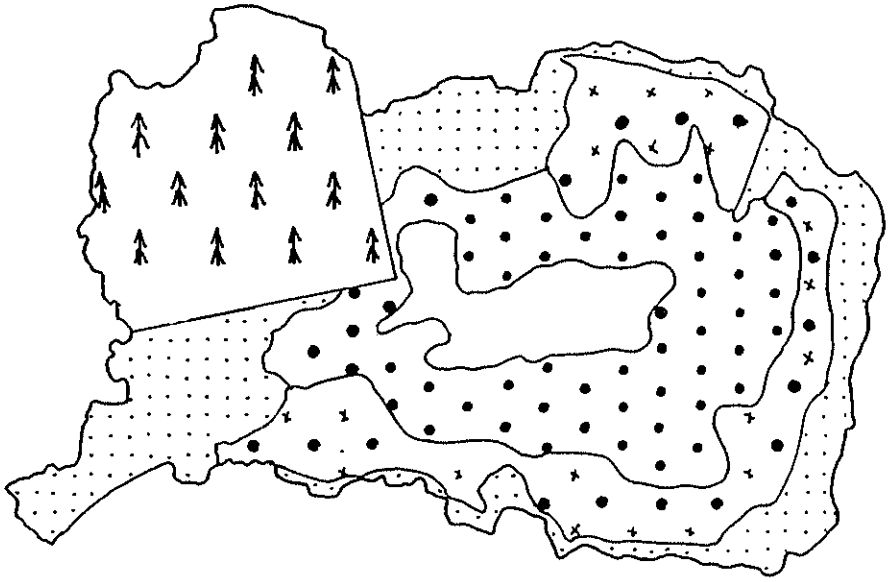
mS/cm

(Fe) iron on H_2O



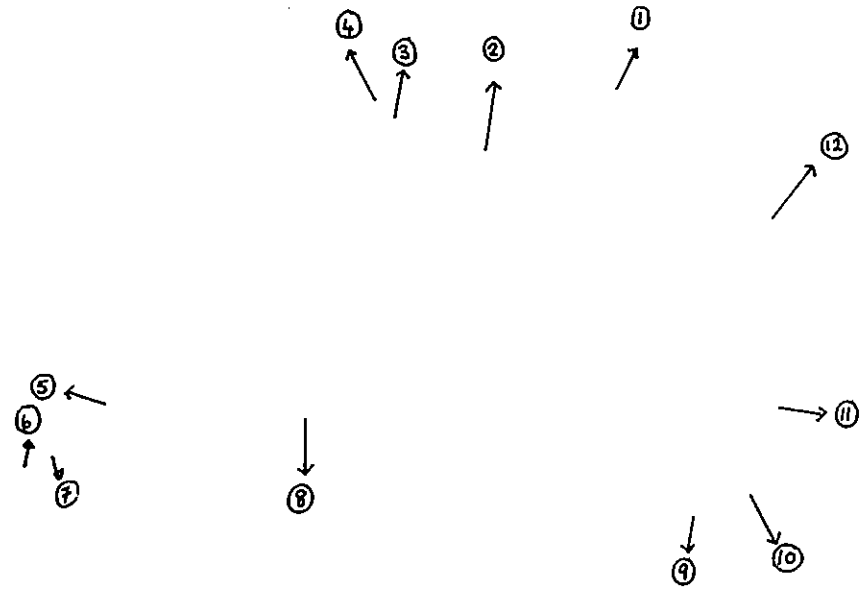
BALLYNAFAGH BOG, CO. KILDARE (391).
VEGETATION MAP (1:10,560)
1994

N



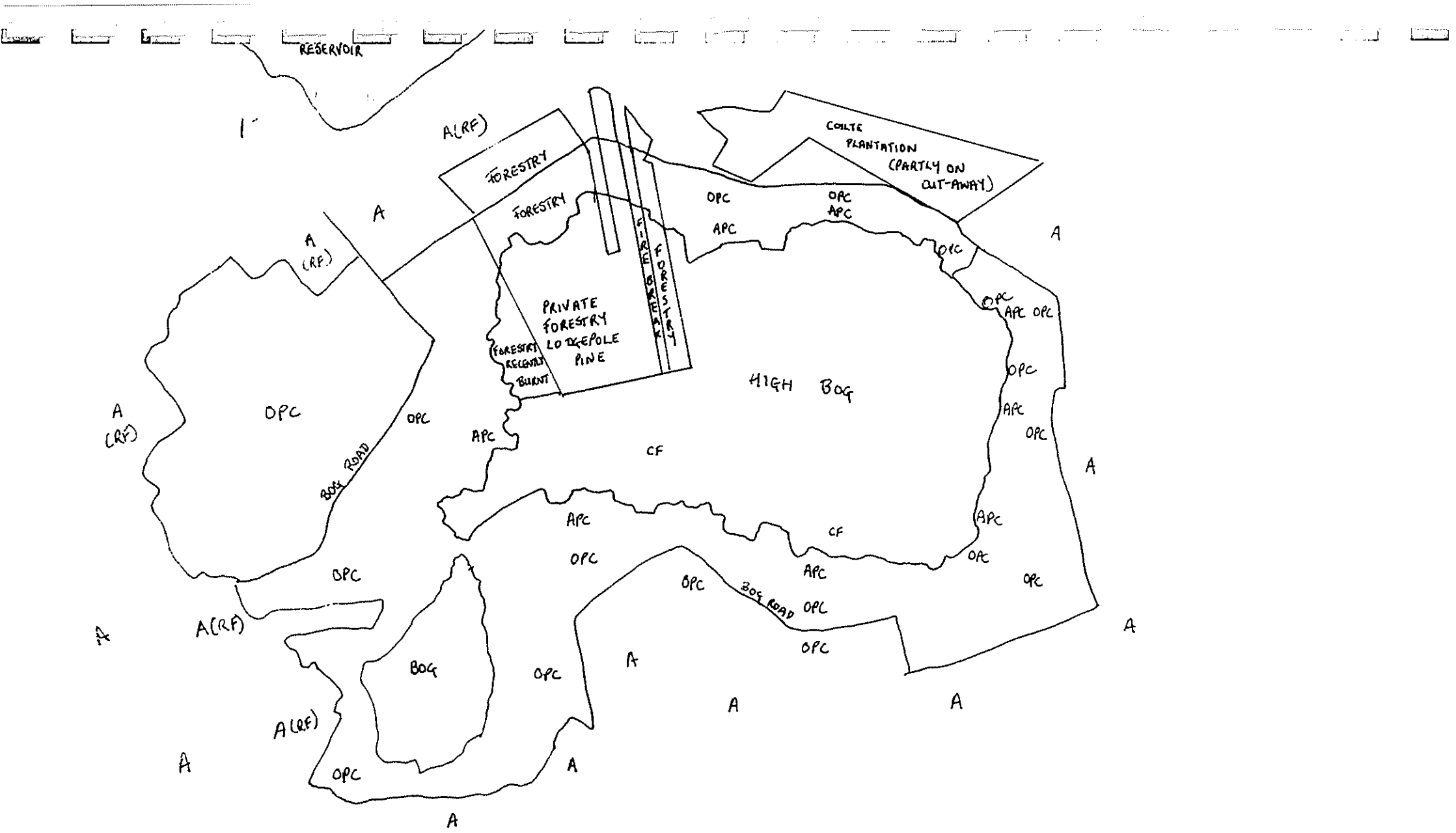
BALLYNAFAGH BOG, CO. KILDARE (391).
ECOTOPE MAP (1:10,560)
1994

N



BALLYNAFAGH BOG, CO. KILDARE (391).
SLOPES MAP (1:10.560)
1994

N



BALLYNAFAGH BOG, CO. KILDARE (391).
LANDUSE MAP (1:10,560)
1994

N

BARROUGHTER, CO. GALWAY

1. SUMMARY OF SITE DETAILS

NHA No.	231	1/2" Sheet:	15
Grid Ref:	M 79 03	6" Sheet:	GY 126
GSI Aerial Photo:	M 454	1:25,000 Sheet:	17/19 NE
NHA Photo:	658:24-25	Area (ha):	91.5 (High Bog)
Date(s) of Visit:	12-5-94 & 12-10-94 (Ecology) 12-5-94 & 12-10-94 (Geohydrology)		
Townland:	Moannakeeba East.		

2. INTRODUCTION

2.1 BACKGROUND

The site was selected as part of this survey for a number of reasons: it was classified as an A site following the National Raised Bog Survey (Cross, 1990); it represents one of the more SW raised bogs and if selected for conservation some of the variation in both E/W and N/S gradients would be preserved; at the E of the bog, succession from open water through extensive reed beds, marginal scrub and raised bog adds to the habitat diversity; a study of recent aerial photography (1993) revealed that the bog appears intact but that there is extensive peat cutting around the edges.

The bog was visited in 1983 during the National Raised Bog Survey (O' Connell and Mooney, 1983). In general the peat was found to be soft and the bog very wet and quaking, especially in the centre. It also had a diverse *Sphagnum* cover including the rare *S. pulchrum*. Impacts of drainage were also noted.

In 1993, as part of the of NHA survey (NPWS), similar findings to those of 1983 were detailed. However, it was also recorded that extensive peat cutting was being carried out around approximately 90% of the site.

The bog is located close to the NW shore of Lough Derg and if preserved could safeguard the habitat diversity of the area.

2.2 LOCATION AND ACCESS

This site is located on the north-western shores of Lough Derg (PL7:28 and PM4:22-24), close to the Clare/Galway border. It lies approximately 8km south of Portumna. The Cappagh river runs to the north-east.

The bog can be accessed from the Portumna to Woodford road with a left turn onto a bog road which runs along a part of the south-west side of the site.

3. METEOROLOGY

No meteorological measurements have been made on Barroughter bog. Rainfall data from the nearby Portumna and Woodford weather stations for the years 1951-80 indicate that the area receives approximately 957mm of precipitation annually (Fig. 5). The nearest synoptic station at Birr suggests that the site could have up to 207 rain days annually.

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly

and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

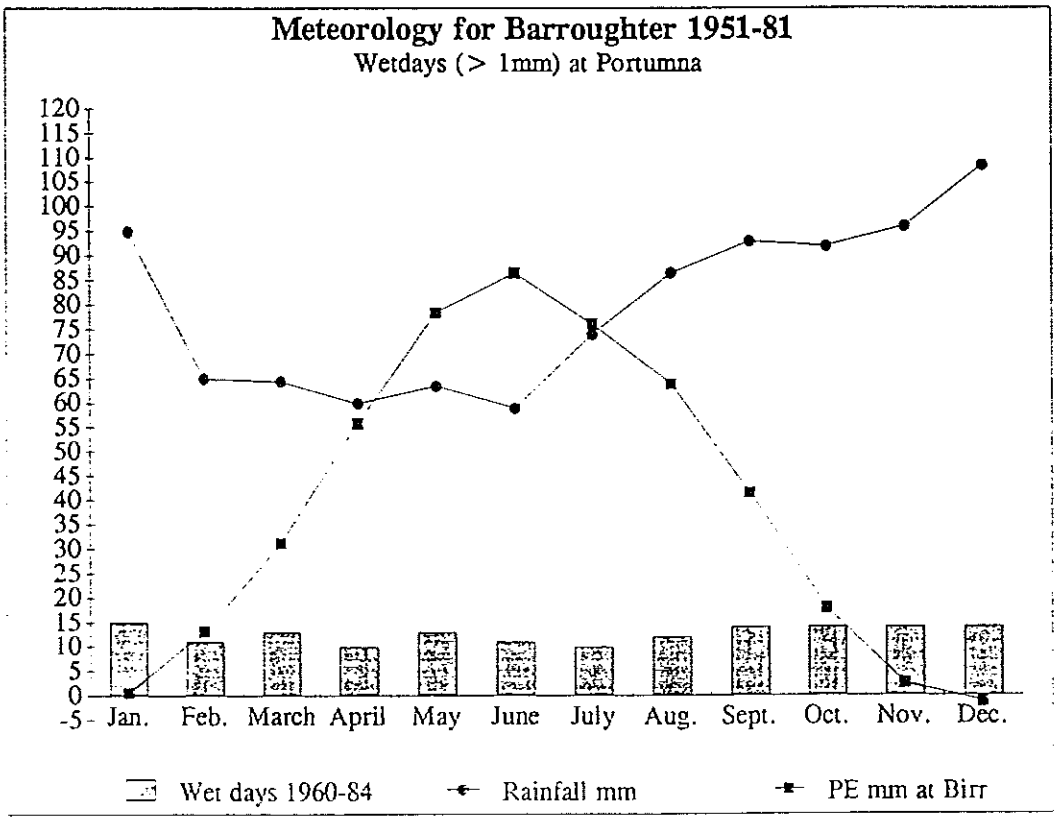
The above factors suggest that the year round actual evapotranspiration (AE) from Barroughter bog is greater than PE at Birr, site of the nearest synoptic station which had an average PE of 466.5mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Barroughter would therefore be greater than 466.5mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 490mm/yr.

Meteorological data for Barroughter Bog (1951-1981) are summarised below:

Rainfall (P)	957mm/yr
Actual Evapotranspiration, (AE)	>466.5mm/yr
Potential recharge, (PR)	<490mm/yr
Raindays > 0.2 mm (annual {1951-1980})	207 days
Wetdays > 1mm at Portumna (annual {1960-1984})	150 days

Figure 5:



4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

In plan the site reaches a maximum length of 1500m in a NW to SE direction. It is thinnest in an east-west direction where it has an average width of 750m. The southern section of the bog is at a slightly higher altitude than the northern part (PL7:30).

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

The site is surrounded by low lying land where height ranges 38-39.5m O.D.. The entire eastern section of the bog is adjacent to the shores of Lough Derg and the floodplain of the Cappagh River. The Slieve Aughty mountains lie 3km to the west of the site.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by dark grey muddy fossiliferous Carboniferous limestones (shown as ABL, on map), interbedded with thin calcareous shales. The south eastern section is directly underlain by Waulsortian Carboniferous limestones (fossiliferous mudmounds). The Old Red Sandstone Slieve Aughty inlier lies 3km to the west.

The muddy fossiliferous limestones generally have a low permeability and are classed as a poor aquifer. The Waulsortian limestone also has a low permeability.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

No subsoils data were available for Barroughter bog apart from the initial 1840s GSI geology field sheets and recent fieldwork carried out for this study.

Geology of Inorganic Subsoils

The subsoil geology of this bog and surrounding area is dominated by limestone till. Sections in drains on the cut-away areas indicate that the outer limits of the bog are underlain by poorly sorted clayey tills with relatively large sub-angular clasts composed of limestone. Sections in the northern and southern cut-away drains show that calcareous shell marl with a silt matrix also underlies the peat. Pure sand underlies the peat in western sections where the EC is 150 µS/cm.

It is believed that Barroughter bog is predominantly underlain clay rich tills or clays given its proximity to a floodplain. The high proportion of fines in the tills suggest that it has a low permeability.

Peat

Geological maps produced in the 1840s show that peat once covered large expanses of low lying ground below the 38m OD contour where it extended onto the shores of Lough Derg and along the Cappagh River.

5.1.3 Depth to Bedrock

There are limestone outcrops directly north, south-west and south-east of the bog. Depth to rock on the bog is unknown; although it is thought to be close to the surface given its proximity to the lake and local outcrop.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology

Most of the drains on this site are old and infilled or dry. Only one active drain transverses the site in the north-east. Another old drain runs south-west/north-east at the north-western side. This is mostly infilled. The remainder are short drains leading from the cut-away onto the bog associated with peat extraction. Around these short drains the peat has dried out and the face bank complex, dominated by *Calluna vulgaris*, may be seen. The main effect on the vegetation of this site is the peat cutting which is causing drying out all around the edges. The drains are shown on the Drains Map of the site.

North

Drain bA, runs south-west/north-east at the north-western side of the site. It is old and is infilled at the west side *Narthecium, Trichophorum, Calluna, Sphagnum magellanicum, S. papillosum, Aulacomnium palustre, Eriophorum angustifolium, E. vaginatum* and scrub *Betula*. At the northern end of this drain there is flow to the N with 25-30cm of water in places. Here the drain is colonised by *S. cuspidatum, S. auriculatum, Calluna* and *Narthecium*. The drain at this side is 1m wide.

Drain bB, at the north-western side of the site is a new short drain, 0.5m wide and is bare. There is flow to the NW.

Drain bC is similar except the flow is to the northern edge. The sides of tbe drain were coated in algae.

Drain bD is 1m wide by 0.5m deep with 40cm of water flowing to the north. It runs along a townland boundary and cuts off a part of the NE section of the site. It is semi-collapsed and at the northern side is mostly bare with some *Sphagnum auriculatum* and *Juncus bulbosus* with *Myrica* along the edges. At the SE end of this drain is wider, 1.5m wide and 1m deep with 15-20cm of water with no flow (EC 74 µS/cm). Species colonising the drain at this edge included *Sphagnum subnitens, Betula, Salix* sp., *Rubus, Molinia, Dryopteris, Carex rostrata, Narthecium* and *Potamogeton polygonifolius*.

East

Drain bE is the longest drain in this area running SE/NW. A small flush may be seen at its NW end. It is infilled with tall *Calluna* and *Betula* with *Potentilla erecta* along its edges.

Drain bF is one of the more significant drains on the eastern edge of the site. All the drains in this area are old, infilled and collapsed with *Betula* encroaching onto the high bog along them. However the vegetation of Drain bF was indicative of higher base status (EC 257 µS/cm) with *Phragmites, Carex acutiformis* (not flowering), *Calliergon cuspidatum* and *Potamogeton polygonifolius*.

Drain bH is similar to bF.

Drain bJ runs close to the road on the SE side of the site between the lake and the high bog (PM4:26 including the *Betula* east of drain). It is 3m wide in places and has 30cm water. It is colonised by *Sphagnum cuspidatum* and *Eriophorum angustifolium*.

Drain bK running N/S at the southern end of the site is up to 1m wide with 20cm of water with a slight flow to the S. The sides have collapsed at the southern end.

South-west

Drain bM has 15cm of water with a slight flow to the S with *Betula* colonising along its edges.

West

The remainder of the drains along this edge are short with tall *Calluna* and *Betula* along their margins. Drains bN-bQ and bS are collapsed and up to 2m wide with very small flow to the bog

edge. They are colonised by *Narthecium, Eriophorum angustifolium, E. vaginatum, Calluna* and *Erica tetralix*. Drains bU-bW are smaller than the above and have no flow.

Drains bR and bT are also 2m wide and collapsed but support some *Sphagnum cuspidatum* and *S. capillifolium*.

5.2.2 Bog Margin Hydrology

The principal drains have been labelled on the Drains Map and are discussed separately below.

West, mB to mZ

There are a high density of drains that move water from the bog face to the cut-away, but there are very few corresponding drains on the high bog. All drains in the cut-away have a maximum width of 1m and a depth of 0.6m with an EC in the 90 µS/cm range.

South/South West

A main outer drain, mZ (2m deep x 2m wide) collects water from the southwestern/western cut-away drains and flows SE to Lough Derg. At mW - mV, cut-away drains sit on a high till mound where ECs are 340 µS/cm. There is a deep 3m face at mR where the face drain is 1m wide and 0.3m deep. Generally there is little flow in the cut-away marginal drains and the high bog drains in the SW.

East

Up to fifteen drains in the cut-away, drain the eastern section of the bog, north of bJ. They flow east into a larger drain that flows north to the Cappagh River. Most of these drains are overgrown causing some parts of the cut-away to be wet, allowing regeneration and growth of *Sphagnum*. Several of the faces are slumped with face heights of only 1.5m in some cases.

North-East past Drain bD

There are very old faces present here. The corresponding cut-away is within the River Cappagh floodplain where the ground is very wet and treacherous to walk on. All the cut-away drains are overgrown; it is hard to make out the original drains. Grasses and *Phragmites* grow here.

North

These cut-away drains (>2m deep) flow north into a large collector drain which flows east to the lough via the Cappagh River. In the lower reaches of the main drain the surrounding ground is wet. The Cappagh River floods this area.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Hydrochemistry Map)

Water flowing from the bog and the adjacent inorganic subsoil was sampled on the 12-5-1994. There had been several heavy rain spells over the previous three days. Water flowing off the bog had low ECs, typically less than 100 µS/cm. These values are similar to that of rainfall reflecting the largely inert nature of the peat. In contrast relatively high electrical conductivities (270-470µS/cm) were noted in drains mX, mW - mR, mF - mE, mY and mD1-3; all had considerable shows of iron.

The high EC values at mX are coincident with sections of sand seen to underlie the peat and the growth of *Phragmites*.

The high EC values at mW - mR along the south-west of the bog are coincident with an area of noticeably high ground in the cut-away, where *Phragmites* is dominant. At mV, the EC was 340 µS/cm with a temperature of 10.1°C. General temperatures of bog water that day were 14.6°C. It is thought therefore that groundwater is upwelling at these drains in the cut-away.

In the east several of the open drains north of bJ in the cut-away have ECs of > 270 µS/cm. At mF and mE, ECs are in the 240 µS/cm range. The vegetation seen here indicates a higher base status. It is thought that these drains intercept the water-table of local groundwater which would be very close to the surface here, since the lake is only a maximum of 20m from these drains.

At mY, there is a 280 µS/cm EC. It was thought to reflect that surface water is flooding the cut-away. This cut-away area was revisited on the 12th October 1994, where ECs of 650 µS/cm indicated that regional groundwater was upwelling between the bog faces and the River Cappagh. The vegetation in this area indicates that the floods in May were not caused entirely by the river since there are several *Sphagnum* hummocks. The May 'flooding' that was seen in the visit was probably caused by a rising watertable and increased runoff from the bog. Certain areas on the cut-away in October had ECs of 250 µS/cm caused by the mixing of bog runoff flowing to one spot where it mixes with groundwater.

5.3.2 Laboratory Hydrochemistry

No samples were taken for analysis at the Coillte laboratory.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation

This bog lies alongside a lake shore and small river estuary and formed in a floodplain area since Lough Derg may have been at a higher level than present.

Groundwater flow is thought to mirror topography, recharging at the foothills of Slieve Aughty and flowing east under the bog discharging to Lough Derg, the hydraulic low point for the region. The bog lies in a regional groundwater discharge zone.

Only a low proportion of rainfall is thought to recharge to groundwater in the region since there are high levels of runoff from the widespread clay tills. There are several streams and rivers in the area. The Cappagh River which is the main river runs NE of Barroughter Bog and flows south into Lough Derg.

Bog Regime

Most of the drains on the high bog are inactive, overgrown or dry. All the drains are relatively short on the high bog except for bD in the NE. Generally the bog has a high density of marginal drains due to extensive hopper cutting. There are several areas where faces have collapsed or dried out.

Inter-relationship

In the NE, at the lake shore the regional groundwater-table would be at or near the surface and the floodwater of the Cappagh River inundates the cut-away area in parts. This area was again visited in October 1994. ECs of 650µS/cm with fen vegetation indicated that regional groundwater was indeed upwelling between the bog faces and the River Cappagh forming the potential to create a lag zone.

Most of the cut-away drains at Barroughter are thought to intercept the shallow groundwater table. Hence the cut-away drains act as sites for groundwater discharge. There are high ECs in the northern cut-away drains at D1-D3. Water is seen to bubble up through shell marl exposed in the drains. EC here was 480 µS/cm with a temperature of 9.5°C; carbonate was being precipitated. *Phragmites* and *Typha* lie downstream of these drains. All these events clearly indicate that groundwater is upwelling at the face banks.

6. VEGETATION

6.1 VEGETATION SUMMARY

The vegetation of this site is characterised by an abundance of *R. alba* and *Narthecium* throughout. The wettest part of the bog occurs in the centre of the widest northern part with shallow *Sphagnum cuspidatum* pools and *Sphagnum* lawns with *Menyanthes* but no really good examples of pool/hummock systems. *S. pulchrum* was recorded with the addition of midland indicators such as *Andromeda* (frequent) and *Sphagnum magellanicum*. Both of these species were not as common as on the more eastern raised bog sites. In addition, the western indicators *Pleurozia purpurea* and *Racomitrium* were present in small amounts over the site with some large *Racomitrium* hummocks occurring in the central complex.

There is a small flushed area on this site which appears to be associated with an old drain.

Carex panicea was seen throughout the site apart from the wettest central areas and was abundant near the edges.

The bog has been burnt in the past and the lichen cover is poor the greatest abundance is seen on hummocks.

The vegetation of the cut-aways that have been inactive for some time are colonised mainly by *Betula* and *Ulex*. In the areas close to the active cut-away *Juncus effusus* and grass species predominate. Due to the influence of the lake and river the NE edge has a large stand of *Phragmites australis*. Along the eastern edge the drains in the cut-away are often colonised by mesotrophic indicators such as *Typha latifolia, Carex acutiformis* and *Phragmites* with many others. *Pedicularis sylvatica, Polygala vulgaris* and *Cirsium dissectum* were also common on the drier parts. Behind the cut-away along the east the lake shore is fringed by *Phragmites*.

To the NE of the bog there is a small species rich fen between the bog and the river. The EC in this area ranged from 142-700 µS/cm. The following species were noted: *Salix, Betula, Ulex, Myrica, Carex paniculata, C. diandra, C. echinata, C. rostrata, C. lepidocarpa, Succisa, Juncus effusus, J. articulatus, Ranunculus flammula, R. acris, Mentha, Valeriana officianalis, Cirsium dissectum, Menyanthes, Molinia, Schoenus, Angelica, Pedicularis palustris, Potamogeton polygonifolius, Potentilla palustris, Triglochin palustris, Hydrocotyle vulgaris, Osmunda, Dryopteris, Phragmites, Equisetum fluviatile, Cardamine, Epilobium, Eriophorum angustifolium, Andromeda, Drosera rotundifolia, Hyperichum tetrapterum, Rhytidiadelphus, Calliergon cuspidatum, Scorpidium scorpioides, Fissidens* sp., *Rhizomnium* sp., *Campylium stellatum, Riccardia multifida, Pseudoscleropodium purpurm, Mylia anomala, Sphagnum capillifolium, S. imbricatum, S. papillosum* and *S. tenellum*. Some patches of more ombrotrophic vegetation also occur with *Calluna, Potentilla erecta, Erica tetralix, Aulacomnium palustre, Pleurozium schreberi* and *Dicranum*.

Further along the northern edge in the cut-away there is a small spring in shell marl colonised by *Typha* and *Carex vesicaria*.

Along the river bank *Sparganium erectum, Scirpus lacustris, Filipendula, J. conglomeratus, J. inflexus, Iris pseudocorus, Ranunculus repens, Convularia* and *Nuphar* are some of the species noted.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

The face bank complex, dominated by *Calluna* is found in patches all around the site. It is mainly confined to the drain edges on the east, south and south-western sides of the bog as active peat cutting along most of the western edge has prevented its development. *Myrica* and *Betula* occur in places associated with these drains.

Complex 2/3

This is seen at the SE close to the bog edge. *Trichophorum* and *Carex panicea* dominate. The *Sphagnum* cover is very low and the bog surface is hard.

Complex 3/2/6

This complex occurs in the NW corner and along the northern edge of the bog. It is dominated by *Carex panicea* (25%), *Trichophorum* (15%) and *Narthecium* hollows (10%) and there are some algal hollows (5%). The *Sphagnum* cover is very low and there is no acrotelm layer. It has not been burnt for some time as the *Calluna* is tall and the *Cladonia* cover is higher than in the central complexes, although this may also indicate drying out. The occurrence of *Carex panicea* is therefore most probably associated with greater peat mineralisation due to drainage rather than from fire. However *Campylopus introflexus* was noted, indicating a disturbance event in the past.

In one part of this complex tear pools occur (Complex 3/2/6 + TP) which are aligned more or less at right angles to the slope. This tearing has probably occurred due to the drying out effect of the peat cutting on three sides of this area and water loss through Drain bD.

Complex 3/2/6/4

This is similar to complex 3/2/6 with the addition of *Rhynchospora alba* hollows. It is found on the NE side of the site.

Complex 6/2/3

This is seen at the S of the site. *Narthecium* (25%), *Trichophorum* (20%) and *Carex panicea* dominate with many small algal hollows. The distribution of this complex is probably as a result of a past fire event. It appears to be a degraded form of Complex 6/3/2. The *Sphagnum* cover is low and the surface is mostly hard underfoot.

Complex 6/3/2

This is found along the eastern and southern edges of the site (PM4: 23+25). It is dominated by *Narthecium* with abundant *Carex panicea* and *Trichophorum*. At the NE side there was an area where *Pedicularis sylvatica* occurs. Algal hollows are also common (10%) with a lot of surface water. The overall *Sphagnum* cover, mainly *S. capillifolium* low hummocks, was 10%. The *Calluna* was tall and the *Cladonia* cover was significant (10%) indicating that there was no recent fire history.

Complex 6/2

This marginal complex is seen along the west edge, the south and a small area in the NE - all areas of active peat cutting. The vegetation complex is dominated by *Narthecium* hollows and the cover of *Trichophorum* is high probably due to the drying out effects of peat cutting (PM4: 24). *Sphagnum* cover is low and the bog surface is mostly hard.

Complex 4/2
This is a small area of vegetation seen at the NW edge with erosion channels colonised by *R. alba* with *Trichophorum* tussocks and algal hollows. *Molinia* is encroaching onto the bog in this area.

Sub-Marginal Complexes
Complex 6
This covers an area on the mid-west to NW edge and is dominated by *Narthecium* hollows with tall *Calluna* (0.4m) and a moderate *Sphagnum* cover. The bog surface is a little soft in places.

Complex 4/6/2
This complex is dominated by *Rhynchospora alba* flats and *Narthecium* hollows with the addition of *Trichophorum*. It is seen along the slope on the western side of the site. The *Sphagnum* cover is poor.

Complex 4/6
This complex is also dominated by *Rhynchospora alba* flats and *Narthecium* hollows (PL7: 24 to N). *Sphagnum* cover is low (10%). Typical hummocks, in this instance mainly composed of *Eriophorum vaginatum, Erica tetralix* and *Calluna* cover 45% of the area. Some of the taller hummocks were colonised by *Aulacomnium palustre* and *Hypnum*. *S. capillifolium* and *S. tenellum* were the principle bryophytes found. Patches of *Carex panicea* also occur.

A small area of this complex type, which has been recently burnt, is found to the west of Drain bD (4/6 RB). The *Calluna* cover is very low and there are some tear pools with no obvious alignment. Most of these are algal but a few contain *R. fusca, Sphagnum cuspidatum* and *Menyanthes*.

Complex 4/6 + Tear Pools
This complex is situated in a depressed area at the north central part of the site and is associated with the extensive slumping and peat cutting in this area. It is similar to Complex 4/6 with the addition of tear pools (10%) which are aligned E/W and NNW/SSE. These pools are mainly algal but there are some with *S. cuspidatum, Eriophorum angustifolium* and some *R. fusca*. There is an abundance of *Erica tetralix*. The *Calluna* is tall (0.4m) and there are patches of *Carex panicea*.

Complex 6/10 RB
This is a small area of recently burnt (3-4 years) vegetation on the NE section of the site with *Narthecium* hollows and a moderate *Sphagnum* cover.

Complex 4/6/10^{-}
This complex is similar to Complex 4/6/10 but with a lower *Sphagnum* cover. It is dominated by *R. alba* and *Narthecium* with a total *Sphagnum* cover of 30% (PL7: 26 to SW). The hummocks are large and many of these are dominated by *S. fuscum* (PL7: 25 and PM4: 21) and *S. imbricatum*. There are occasional algal hollows and small *S. cuspidatum* pools, some with *Menyanthes*. An acrotelm layer is present in this complex but is variable in depth. The structure of this complex differs to above due to the presence of higher and more frequent hummocks. Some of these are topped by *Vaccinium oxycoccus, Empetrum, Dicranum, Leucobryum* and *Hypnum*. Within this complex there is a small mound with *Betula* (3m tall) and *Calluna* (1m) with a 3/2 lichen cover. Additional species at this mound are *Juncus effusus, Rubus, Potentilla erecta, Rumex* sp., *Salix, Empetrum, Rhytidiadelphus squarrosus, S. palustre, Eurhynchium* sp., *Dicranum* and *Pleurozium schreberi*. Other species in the complex include *Pleurozia purpurea* and *Racomitrium lanuginosum*.

A recently burnt version of this complex (4/6/10^{-} RB) is found to the south of the site/complex. This is characterised by very short *Calluna* with an abundance of *Erica tetralix*. There is some *Carex panicea* and the *Sphagnum* cover is moderate to good and appears to be regenerating well (PM4: 27 to NE showing 4/6RB and transition to darker complex 6/2 with 3 and PM4: 28 N into 4/6).

Central Complexes
Complex 4/6/10
This complex is characterised by a high abundance of *R. alba* (25%), *Narthecium* hollows (15%) and a moderate *Sphagnum* cover of 35% (PM4:22). There are no well developed pools in this area but

the surface is quaking. There are lawns of *S. capillifolium* and a small amount of *S. pulchrum* (PM4:29 PM18:25+26) with *Menyanthes* growing through the lawns. There are occasional small *S. cuspidatum* pools. An interesting feature of this complex is the number and size of *S. fuscum* hummocks (10%) and 5% *S. imbricatum*. On the larger hummocks *Empetrum, Vaccinium oxycoccus, Pleurozium schreberi* and *Leucobryum* are found.

Complex 4/6/15
This is the wettest central complex on the bog and is found in the mid N central area. The *Sphagnum* cover is high (70%) with much *S. capillifolium* and wide, low hummocks of *S. imbricatum* (10%). Some of the latter are topped with *Hypnum, Vaccinium oxycoccus, Empetrum* and *Leucobryum*. There are permanent pools (10%) with *S. cuspidatum, Menyanthes* and *E. angustifolium* (PL7:27). Towards the N the pools become linear with an E/W orientation. The complex is found in a confined area and appears to be surrounded by slightly higher ground to the NNE and ESE and thus may be associated with subsidence. There is a well developed acrotelm layer within this complex.

6.2.2 Flushes
Flush Z
This is a small flush at the W end of Drain bE. It is colonised by *Betula* and *Rhododendron ponticum* with an understorey of *Empetrum, Vaccinium oxycoccus, Dryopteris, Succisa pratensis, Potentilla erecta, Rubus, Polytrichum commune, Pleurozium schreberi, Aulacomnium palustre* and *Eurhynchium* sp. The *Betula* were covered in epiphytic lichens such as *Usnea, Parmelia* and *Ramalina* sp. (PM4: 22). *Phragmites* extends from the bog edge up along Drain bE.

7. BOG TYPE

This bog has been classified as a Ridge River C bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes
Active peat cutting around most of the site has resulted in severe slumping and cracking of most of the facehanks. This is particularly so along the western edge where the cracking in the peat is up to 3m deep in places. There were steep slopes recorded around the site, which are described approximately below and their positions are illustrated on the Slopes Map.

Slope 1	This slope, on the western side of the site close to the access point, is 1m over 40m (PL7:34 to N shows slope along western edge).
Slope 2	At the NW corner of the site to the NNW, the slope is 1m over 20m.
Slope 3	At the NW corner in Complex 3/2/6 into the cut-away the slope is 1.5m over 35m.
Slope 4	At the central part of the northern boundary close to where Drain bA exits, cracking of the peat has occurred up to 50m into the site. This is probably associated with the tear pool complex immediately to the south. The slope is approximately 1m over 50m in this area.
Slope 5	Along Drain bA northwards to the cut-away the slope is 0.5m over 50m.
Slope 6	Along Drain bD the slope to the NW edge in Complex 3/2/6 is 1m over 200m.
Slope 7	At the mid-eastern side, north of Drain bF, the slope is 1.5m over 50m.
Slope 8	At the SE side of the site from Drain bK eastwards to Drain bJ the slope is 1.5m over 40m.
Slope 9	At the SW edge, north-west of Drain bN, the slope to the cut-away is 2m over 100m.
Slope 10	At the SW edge, north-west of Drain bT, the slope to the cut-away is 2m over 30m.
Slope 11	At the mid-western side the slope is 2m over 30m into an area of active peat cutting.

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

Peat cutting is active around most of the site using the hopper method of extraction (PL7:29 and 31). This site is very accessible for peat cutting as there are roads around most of the bog. There were only two small areas where peat cutting is not being carried out. The first of these was at the NE side where the Cappagh river is close to the bog and forms part of the NE boundary. Lake reed beds form the E boundary. This area is liable to flooding and was wet at the time of the survey. The second area is along the lake shore at the south-east of the site. Here a track has cut through the bog and there has been no peat cutting on the western side of this track.

8.2.2 Fire History

There was only one area of very recent burning, at the NE end of Drain bD. Here the vegetation along the cut-away had been burnt within the past few months. This burning had spread approximately 20 m into the bog and extended along the edge for about 80 metres. Tall *Betula* trees (6 m) had survived the burn. There were two other areas on the high bog, at the NE and S, which had been burnt recently (within the last 3-4 years) but the *Sphagnum* layer had not been completely burnt and was regenerating well. The noticeable difference between these and the non-burnt areas (ie. areas not burnt within the last ten years) was the shortness and lower cover of *Calluna*. The lichen cover throughout was poor indicating a history of burning.

8.2.3 Dumping

Dumping, including household refuse and dead animals, has occurred in many areas around the site.

8.2.4 Agricultural Improvements

Low intensity livestock farming is practised on the mineral soils surrounding the bog. The more poorly drained areas adjacent to the cut-over bog are used as rough grazing or have developed into scrub land. Much of the eastern and NE parts of the cut-away are periodically flooded by the Cappagh River.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. A well developed acrotelm layer is present in Complexes 4/6/15, 4/6/10, 4/6/10^{-}, 4/6/10^{-}RB, 4/6 RB, 4/6 with tear pools and 6/10 RB. A poor acrotelm is associated with Complex 6/3/2 and more or less no acrotelm is seen in complexes 1, 3/2/6, 3/2/6/4, 4/2, 4/6/2 and 6/2.

   At the NE corner of the site where there are no recent drains leading from the high bog, a well developed *Sphagnum* layer extends almost to the high bog edge. This is due to high water table levels and *Sphagnum* regeneration in the cut-away. Water backs up from the lake and River into the drains in the cut-away thus impeding drainage. The acrotelm cover is poor over much of the southern side of the site as it is narrower and thus the marginal drainage effects are greater. Where the bog is at its widest to the north a well developed acrotelm layer is most extensive.
   The northern and southern edges of the site have suffered more peat cutting (past and present) than the eastern side (see original peat extent map) and thus the slope of the bog surface towards the cut-away is significant along much of the western and northern edges. This has lead to the development of marginal vegetation complexes. A low *Sphagnum* cover is associated with these marginal complexes and thus there is no acrotelm layer.

2. Complex 4/6 with tear pools is associated with a slumped area at the northern side of the site. In this area the slope to the bog edge is 1m over 50 m. This slumping and cracking of the peat surface has probably been caused by the drainage and cutting of peat in this area. The pools mainly aligned E/W reflecting the stress effect of slumping to the north.

3. *Andromeda* and *Sphagnum magellanicum* were recorded on this site but were not as widespread as they are on the more eastern raised bogs. Furthermore the western indicators

Pleurozia purpurea and *Racomitrium* were noted. This reflects the western position of this site.

4. Mesotrophic vegetation was recorded in drains on the high bog at the eastern side of the side of the site. EC values in the region of 260 μS/cm were noted with associated plant species such as *Phragmites* and *Carex acutiformis*. This again is due to the proximity to the lake. These areas may present possibilities for lagg restoration/development.

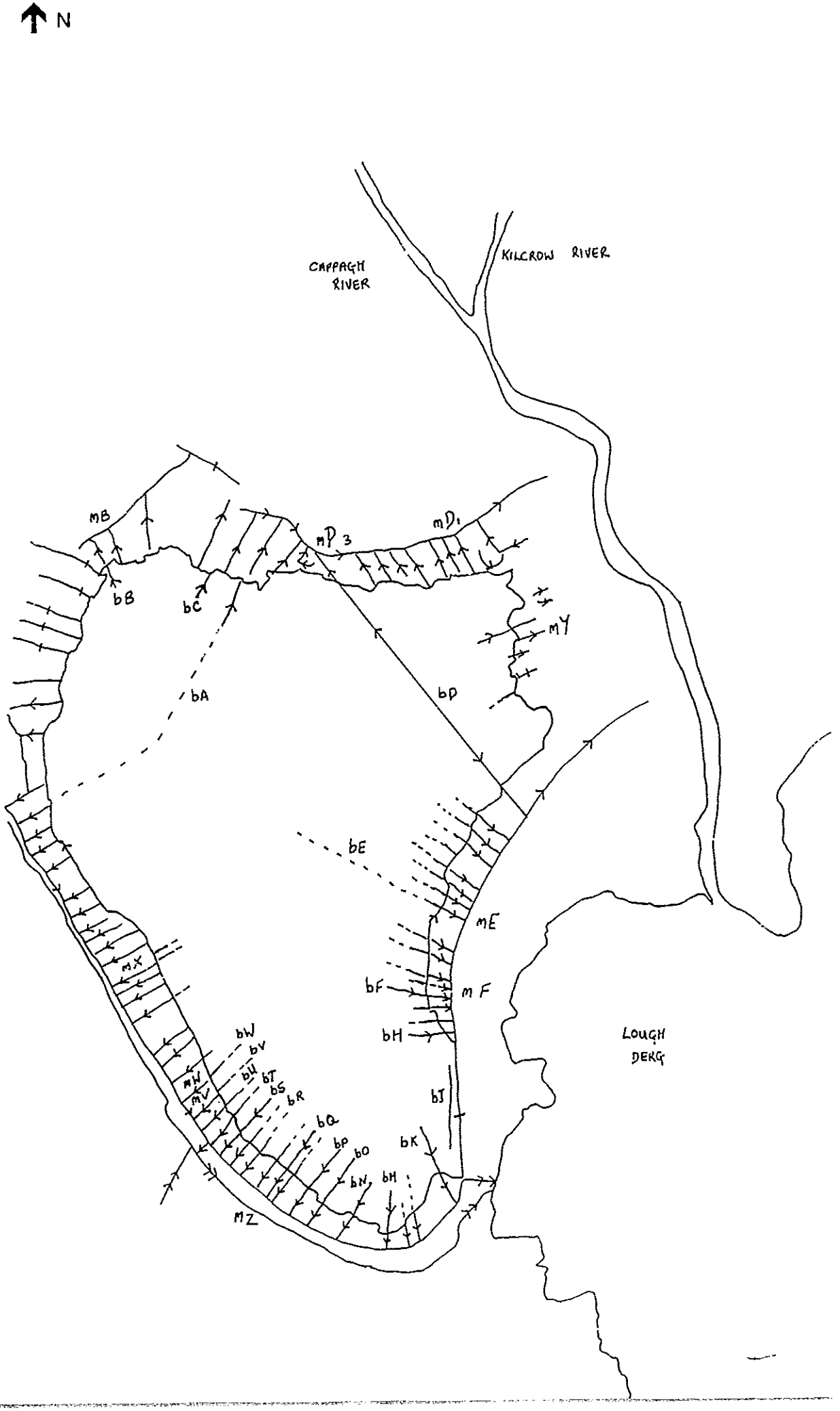
5. *Phragmites* and *Typha* are also seen in the cut-aways at the E of the site in drains with high EC values and also to the NE in the floodplain of the Cappagh River where the surface is very wet (EC 280 μS/cm). *Phragmites* is also seen at the SE of the site in the region of Flush Z, where it is thought to be rooted in the underlying till. A small species rich fen area is seen to the NE of the site between the high bog and the river. This is associated with upwelling ground water and the close proximity of the lake and river.

6. Fire has played an important role at this site and much of the high bog surface appears very uniform. There are no typical tall hummock hollow systems. The central complexes consist mainly of *Sphagnum* lawns with some small *Sphagnum cuspidatum* pools. The hummocks tend to be rather low.

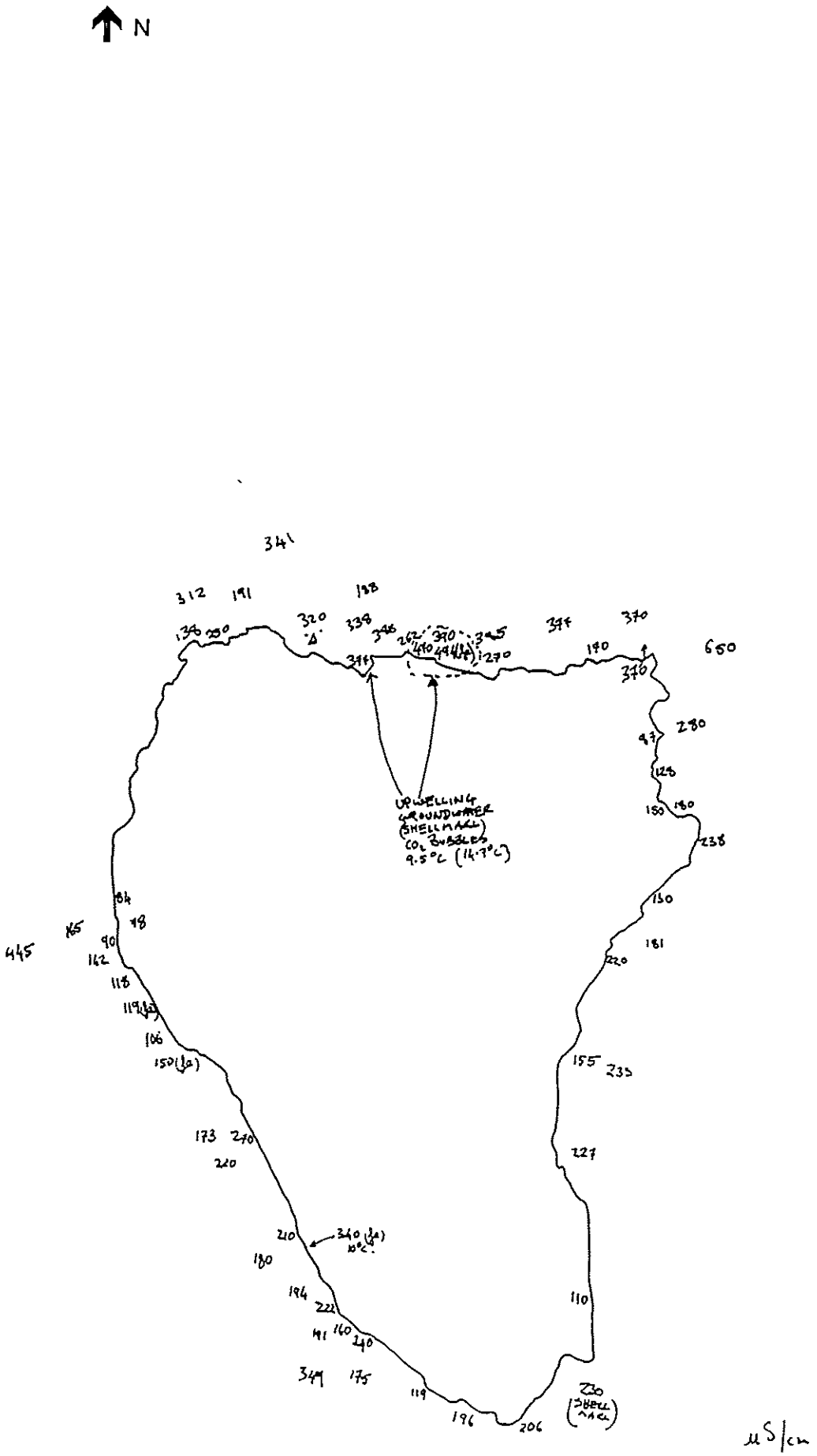
Lara Kelly
Malcolm Doak
Marie Dromey

Raised Bog Restoration Project (1995).

BARROUGHTER BOG, CO. GALWAY (231).
DRAINS MAP (1:10,560)
1994

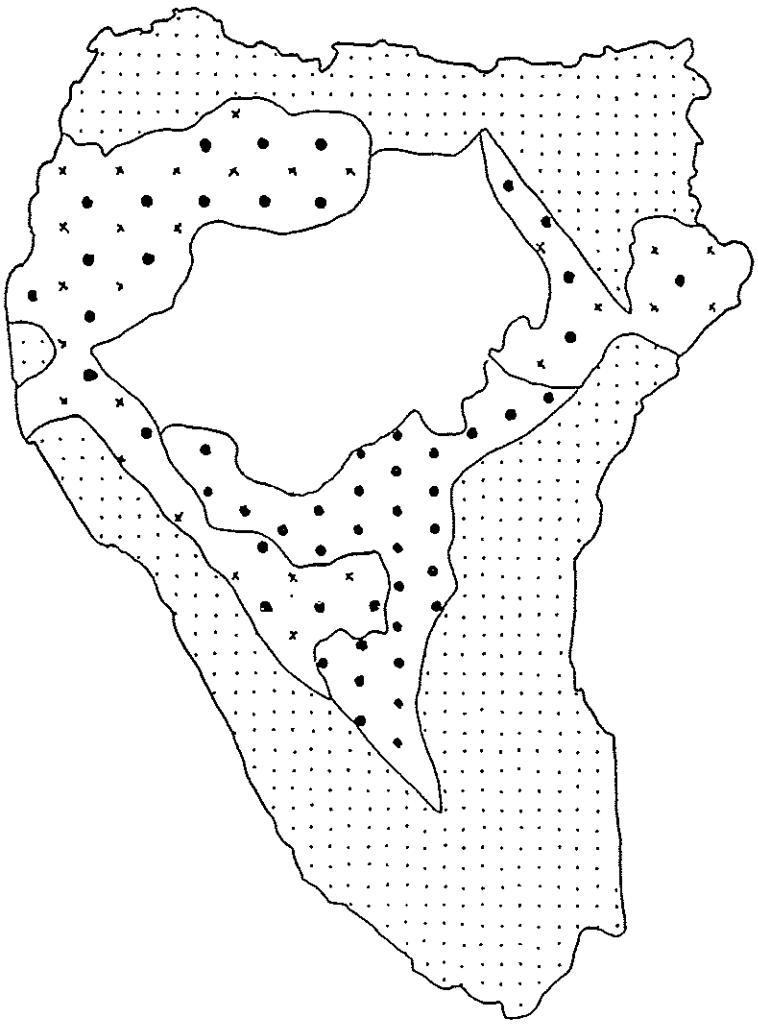


BARROUGHTER BOG, CO. GALWAY (231).
HYDROCHEMISTRY MAP (1:10,560)
1994

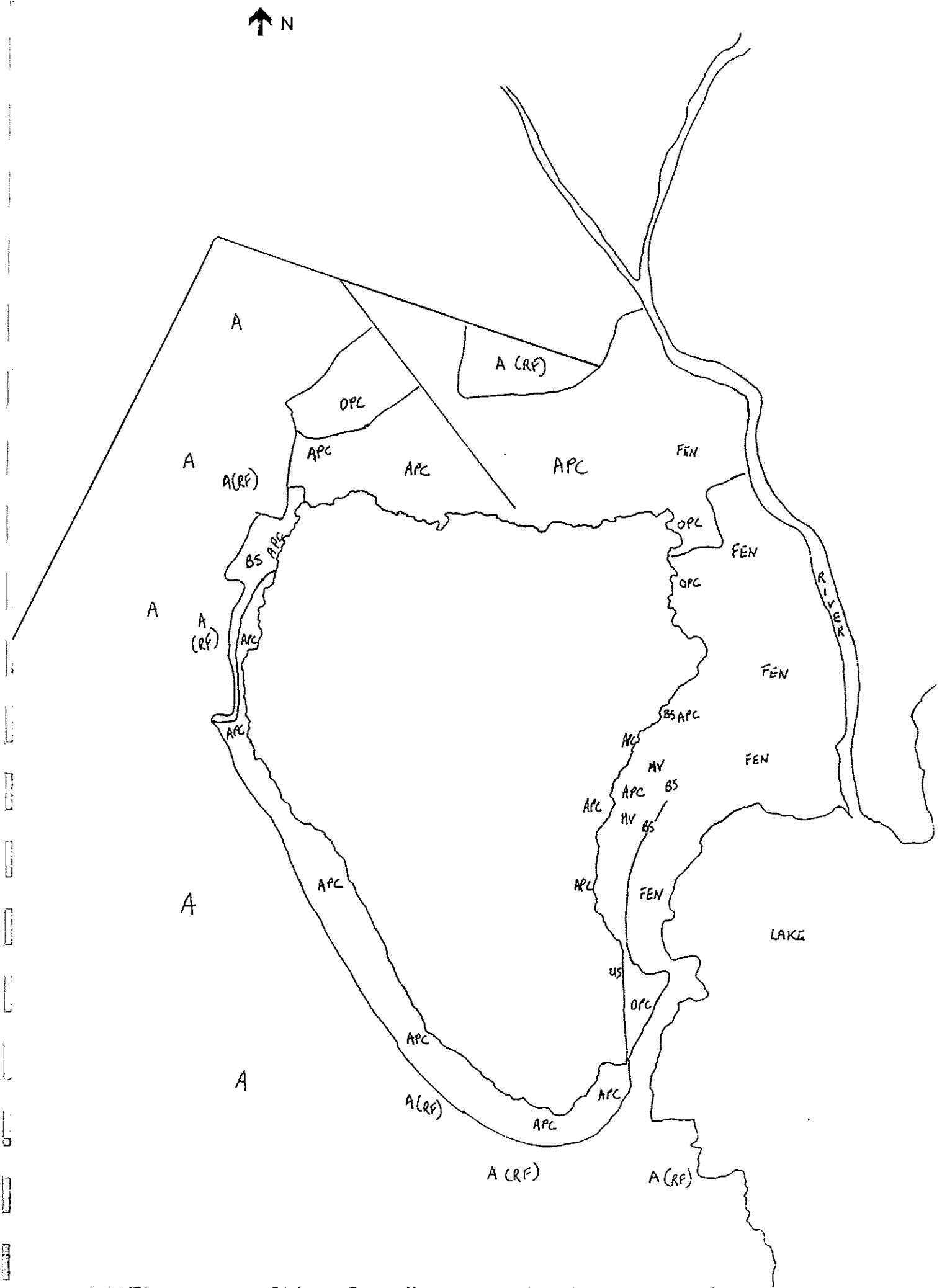


BARROUGHTER BOG, CO. GALWAY (231).
ECOTOPE MAP (1:10,560)
1994

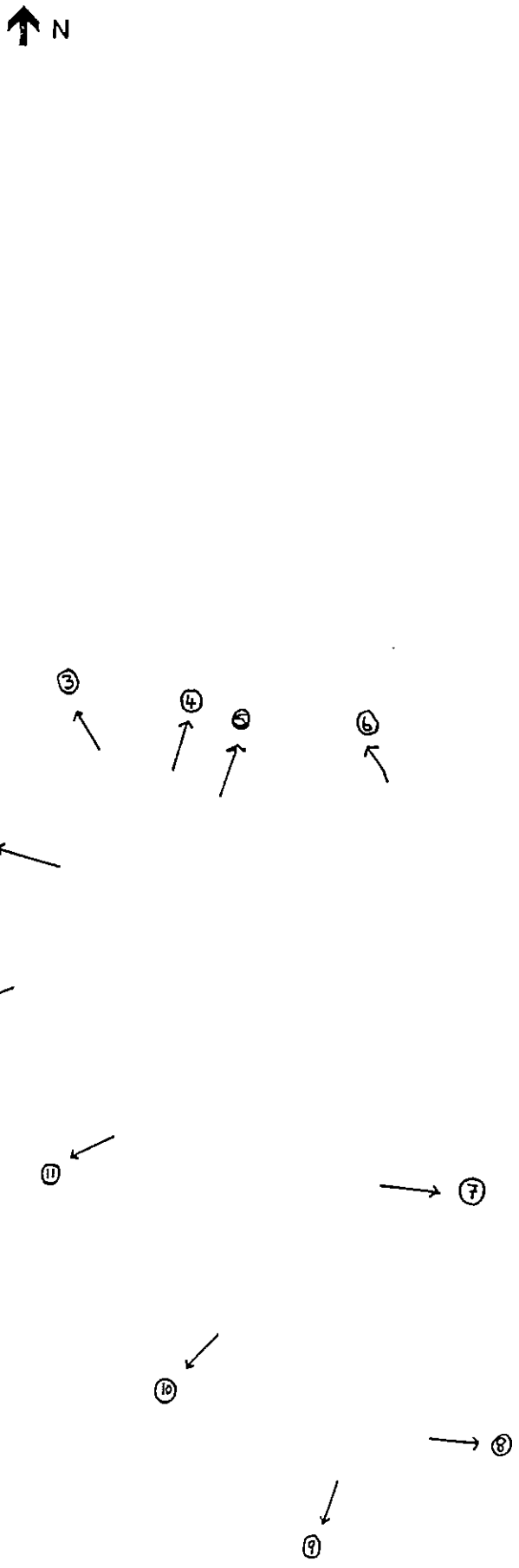
N



BARROUGHTER BOG, CO. GALWAY (231).
LANDUSE MAP (1:10,560)
1994

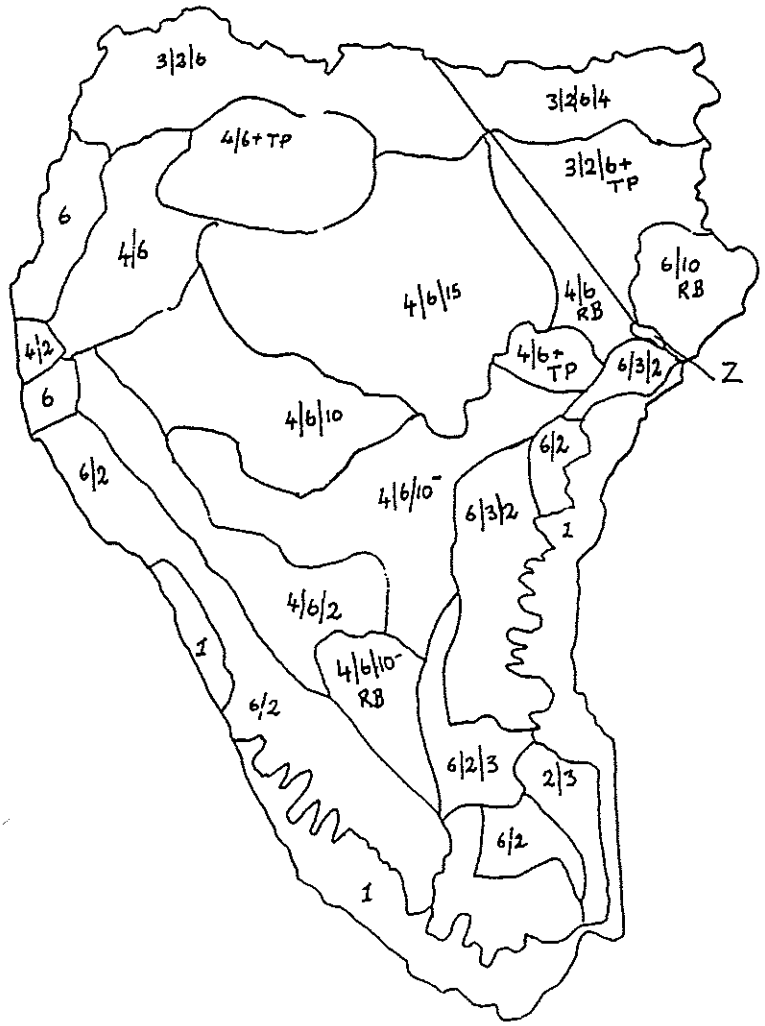


BARROUGHTER BOG, CO. GALWAY (231).
SLOPES MAP (1:10,560)
1994



BARROUGHTER BOG, CO. GALWAY (231).
VEGETATION MAP (1:10,560)
1994

N



BLACKCASTLE BOG, CO. OFFALY

1. SUMMARY OF SITE DETAILS

NHA No.	570	1/2" Sheet:	16
Grid Ref:	N 58 35	6" Sheet:	OY 4
GSI Aerial Photo:	N 482	1:25,000 Sheet:	23/23 SE
Other Photo:	OS (1993 col.) 5837/83	Area (ha):	97.5 (High Bog)
Date(s) of Visit:	9/3/1994 (Ecology)		
	Not visited (Geohydrology)		

Townlands: Ballymacwilliam, Ballybryan and Ballyheashill, Clonmo, Lenanarran, Mountwilson.

2. INTRODUCTION

2.1 BACKGROUND

This site was visited in 1985 by The Forest and Wildlife Service and was given a Bi rating (note in file). It was described as a rather uniform bog with poor development of hummocks and *S. cuspidatum* pools. Frequent burning was noted. Blackcastle was included in the list of possible raised bog NNRs as it is the most easterly bog remaining, apart from Ballynafagh, Co. Kildare, where conservation was still a possibility (Cross, 1990). Cross (*op. cit*) describes it as a wet site with good *Sphagnum* cover which is less damaged than Ballynafagh.

The site was also visited during the NHA Survey in 1993. They highlight that the habitat diversity present is due largely to the extensive cut-away area surrounding the site, while the high bog itself is rather uniform and dry. It is suggested that the site should be designated as a NHA of regional importance.

It is a very dry site surrounded by much cut-away. It was visited during this survey as it is one of the most easterly raised bog sites and because it was included in the possible NNR list.

J. Moore (Local Wildlife Ranger) has information that there are at least 75 owners on this site (NHA file).

2.2 LOCATION AND ACCESS

This small raised bog is situated approximately 3km north-west of Edenderry, Co. Offaly. The site may be accessed by a bog road which runs around much of the site.

3. METEOROLOGY

No meteorological measurements have been made on Blackcastle bog. Rainfall data from the nearby Allenwood weather station for the years 1951-80 indicate that the area receives approximately 793mm of precipitation annually (See Fig. 6). The nearest 'midland' synoptic station at Mullingar suggests that the site could receive up to 218 rain days annually.

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

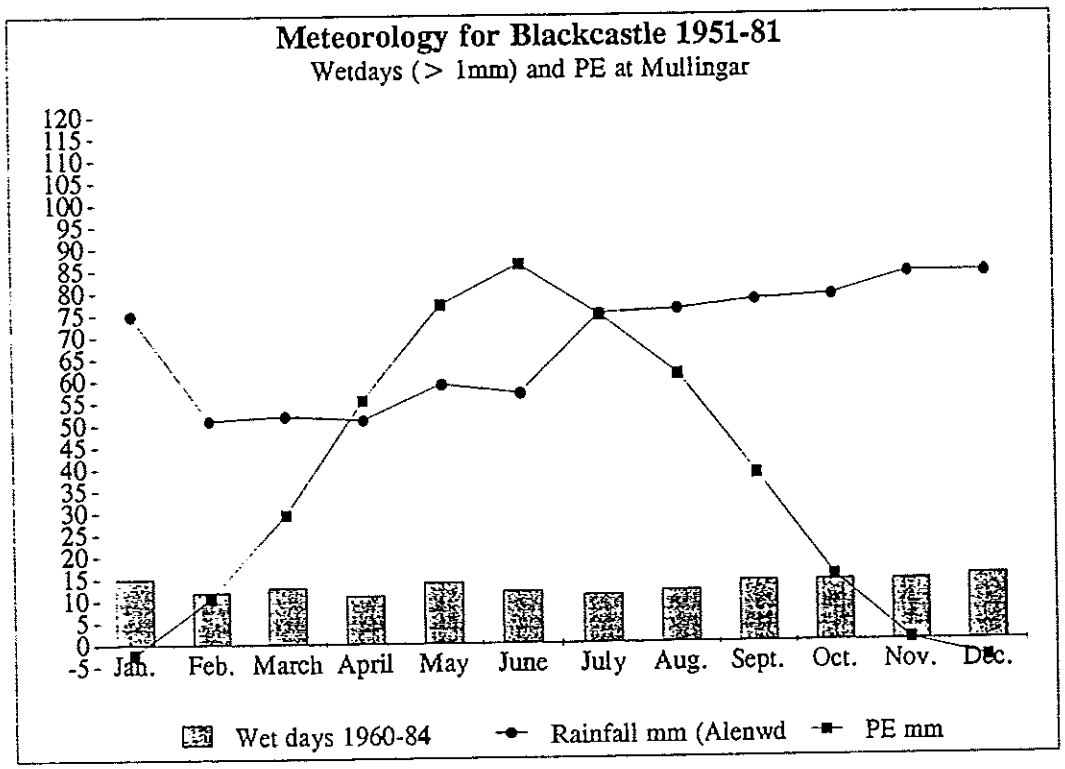
The above factors suggest that actual evapotranspiration (AE) from Blackcastle bog is greater than PE at a synoptic station. Nearest synoptic stations are Dublin Airport, Mullingar and Birr. PE at Mullingar of 442mm/yr (1951-81) is the best indicator for PE at Blackcastle, since the bog is a midland site away from the coast (pers comm. Mr E. Daly).

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore 351 mm/yr.

Meteorological data for Blackcastle Bog (1951-1981) are summarised below:

Rainfall (P)	793mm/yr
Actual Evapotranspiration, (AE)	442mm/yr
Potential recharge, (PR)	351mm/yr
Raindays > 0.2 mm (annual {1951-1980})	218 days
Wetdays > 1mm (annual {1960-1984})	159 days

Figure 6:



4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

This is a very flat site with short marginal slopes associated with peat cutting.
(See 6" 1840s Map)

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by oolitic limestones which have a moderate permeability.

5.1.2 Subsoils

(See 6" 1840s Map)

5.2 HYDROLOGY

5.2.1 High Bog Hydrology (See Drains Map)

Several drains run across the whole site. Most of these are old and are indicated on the 1910 6" sheet of the bog.

Drain bA runs NE/SW across the centre of the site. It is infilled with *Sphagnum magellanicum*, *Eriophorum angustifolium* and some *Polytrichum alpestre* with tall *Calluna* at the edges. This drain appears to be non-functional. It follows a townland boundary on the 1910 6" sheet.

Drain bB with a similar orientation to Drain bA. It is a double drain which, at its northern end, runs through an area of vegetation which has been recently burnt. As the vegetation has been burnt off the drain in this area it is carrying water to the northern bog edge. On the southern side of the site the drains are water filled and colonised by *Juncus effusus*, *Sphagnum cuspidatum* and *Betula pubescens* (PLI:32 toward N). Between the drains in this area Complexes 1 and 2 occur.

Drain bC is an infilled triple drain with *Molinia caerulea*, tall *Calluna vulgaris*, *Polytrichum alpestre* and some *Sphagnum cuspidatum*.

Drain bD is also over grown by *Calluna*. It is a double drain which runs through a very dry section of the site carrying water to the N.

The drains between Drains bC and bD are similar to Drain bD.

5.2.2 Bog Margin Hydrology

No survey of the cut-away drains was undertaken.

5.3 HYDROCHEMISTRY

No hydrochemical samples were collected at this site.

6. VEGETATION

6.1 VEGETATION SUMMARY

The vegetation cover of the high bog is dominated by *Calluna vulgaris* and *Erica tetralix*. *Rhynchospora alba* is more common towards the centre of the site. The *Sphagnum* cover is high within Complex 10 (50-60%) but there are no permanent pools and the presence of either *Sphagnum imbricatum* or *S. fuscum* was not recorded. The occurrence of *Racomitrium* at this site is unusual considering its easterly position. There are many indications of recent burning and a fire history on the site with many patches of bare peat, short *Calluna* and the occurrence of *Cladonia floerkeana* and *Campylopus introflexus*. There are scattered Pines over much of the site especially to the NW, N centre and E of the site. This suggests that the site is quite dry.

The cut-aways support many different vegetation communities including those dominated by the following species: *Ulex*, *Pteridium*, *Molinia* and *Betula*. The latter is the most frequent type. There are also some areas of wet grassland.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

This is the *Calluna/Hypnum jutlandicum* dominated vegetation which occurs close to the facebank edge at all edges of the bog. The *Calluna* is tall (0.6m). *Sphagnum capillifolium* and *S. magellanicum* low hummocks also occur with some *Narthecium* dominated hollows. The lichen species *Cladonia portentosa*, *C. squamosa* and *C. subcervicornis* var. *verticillata* were recorded in this complex. On the northern margin of the site this complex has a higher percentage of *Narthecium* hollow cover (30%). Small algal pools also occur.

Towards the northern edge of the site this complex has a slightly higher *Sphagnum* cover and the *Calluna* is shorter possibly indicating wetter conditions. This may be due to surface water run-off (PL1:27 toward west shows the slope of the northern edge and the boundary between Complexes 1 and 7).

Complex 2

This complex is seen on the sloping area to the east and south of the site. *Trichophorum cespitosum* is the dominant species (60%) with the burnt community types also common (*Cladonia floerkeana* and *Campylopus introflexus*). *Narthecium* hollows also occur. This area has been burnt in the past but not for some time as lichen species such as *Cladonia portentosa* and *C. uncialis* were also recorded. On the southern side of this complex *Rhynchospora alba* was recorded.

Recently burnt Complex (RB)

This area, along the mid northern edge, has been burnt very recently, that is since the last growing season. *Campylopus introflexus* is abundant and algal cover is high (15%). Some *Sphagnum* hummocks have survived burning and should recover (PL1: 28 west toward Derrygreenagh shows recently burnt vegetation and PL1:29 shows the N section of drain B.

Complex 3/7

This area of vegetation which is dominated by *Calluna*, *Carex panicea* and communities indicating disturbance is seen at the western side of the site. The bog surface is not soft as the *Sphagnum* cover is quite low.

Complex 3 RB

This complex occurs near the south western edge of the site. It is similar to Complex 3 (below) but was only burnt approximately 2 years ago. The *Calluna* is regenerating but the *Sphagnum* species have been destroyed. *Eriophorum vaginatum* re-growth is good (PL1:33 toward SSE shows burn patterns).

Complex 3

This corresponds to an area which has suffered a history of burning. This is indicated by the frequent occurrence of *Campylopus introflexus* (disturbed/burnt community type), dominance by *C. panicea* and areas of bare peat. *Sphagnum* cover is low and the *Narthecium* hollow community type accounts for approximately 20% of cover. Algal pools (20%) occur and there is some healthy *Sphagnum cuspidatum* growth in these. This area is situated in a sunken section along the northern edge of the

bog and there was a lot of surface water at the time of the survey. This may account for the higher cover of *Eriophorum vaginatum* and the occurrence of *Rhynchospora alba*.

To the very east of the bog there is a small area of this complex with a slightly higher *Sphagnum* cover and *Eriophorum vaginatum* is more abundant. However areas of bare peat and the occurrence of *Campylopus introflexus* still suggest a fire history. The *Narthecium* hollow cover is similar. On the southern edge of this complex Scots Pine (*Pinus sylvestris*) is encroaching onto the high bog (PL1:30 toward east). Some *Betula pubescens* saplings also occur on the high bog. *Racomitrium lanuginosum* was recorded in this area.

Complex 7/9
A *Calluna* dominated complex dominated by the community type with abundant *Calluna* and *Hypnum jutlandicum* is seen as a sub-marginal complex around much of the bog. The *Sphagnum* cover is higher (10%) than in the face bank complex with *S. magellanicum*, *S. papillosum* and *S. capillifolium* hummocks and up to 40% cover of *Eriophorum vaginatum*. The lichens *Cladonia ciliata* and *C. uncialis* were noted and occasional *Pinus sylvestris* plants occur in this complex.

Complex 7/9+ Cl (*Cladonia*)
This is seen to the N of the site and is similar to the above but with a 40-50% cover of *Cladonia portentosa*. This corresponds to an area which has not been burnt for some time.

Sub-Marginal Complexes
Complex 6
A small area to the southern side of the site is characterised by a high frequency of *Narthecium* hollows (35%). An area of abandoned difco cut peat lies close to this area.

Two small areas of this complex are also seen to the NW with the addition of communities indicating a fire history. Occasional hummocks of *Polytrichum alpestre* and *Calluna vulgaris* occur. *Sphagnum* cover reaches 25% in places, the dominate species being *S. capillifolium* (15%), *S. magellanicum* (5%) and *S. papillosum* (5%).

Sub-Central Complex
Complex 10
This is seen in the central section of the site. *Sphagnum* cover is quite high (50-60%). It is not a central community as there are no permanent *Sphagnum cuspidatum* pools and any hummocks over 10cm which occur are not composed of *Sphagnum* species. The *Sphagnum* species which do occur, mainly *S. papillosum* and *S. magellanicum* with some *S. capillifolium*, form low hummocks and lawns. There are some very small hollows with *Sphagnum cuspidatum*. *Eriophorum vaginatum* cover is approximately 40% and *Narthecium* hollows also occur. There are scattered hummocks *of Leucobryum glaucum* with occasional hummocks of *Polytrichum alpestre*, *Aulacomnium palustre* and *Dicranum scoparium*. These hummocks may be up to 0.7m in height and 2m wide (PL1: 31 toward ESE).

Complex 10/4
This is similar to the above and found in association with it. Tracts of *Rhynchospora alba* are more frequent and extensive. This may indicate slightly wetter conditions as their occurrence corresponds to the most central section of the site.

7. BOG TYPE

This is probably a basin bog.

8. HUMAN IMPACT

8.1 RECENT HUMAN IMPACT (See Landuse Map)

8.1.1 Peat Cutting

The area of cut-away peat surrounding this site is extensive. Active peat cutting (APC) may be seen on sections of the northern and southern margins. This is being carried out using both the difco and hopper methods.

8.1.2 Forestry

Areas of coniferous forestry lie to the east and NNW of the site on cut-away peat.

8.1.3 Fire History

Burning seems to have been a frequent occurrence at this site as the *Calluna* tends to be rather low and lichens are more or less absent on most of the site except those species which indicate disturbance. There are practically no hummocks and many of the complexes contain community types which indicate a fire history.

8.1.4 Dumping

There is a lot of dumping of household and farm refuse around the edges of this bog, particularly to the NW.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. This site was surveyed as it is one of the most easterly raised bog sites remaining although it was apparent from the aerial photography and existing information that the site was rather poor.

2. This visit confirmed that the site is extremely dry and that there are no typical central raised bog communities, with no permanent pools or well developed *Sphagnum* hummocks.

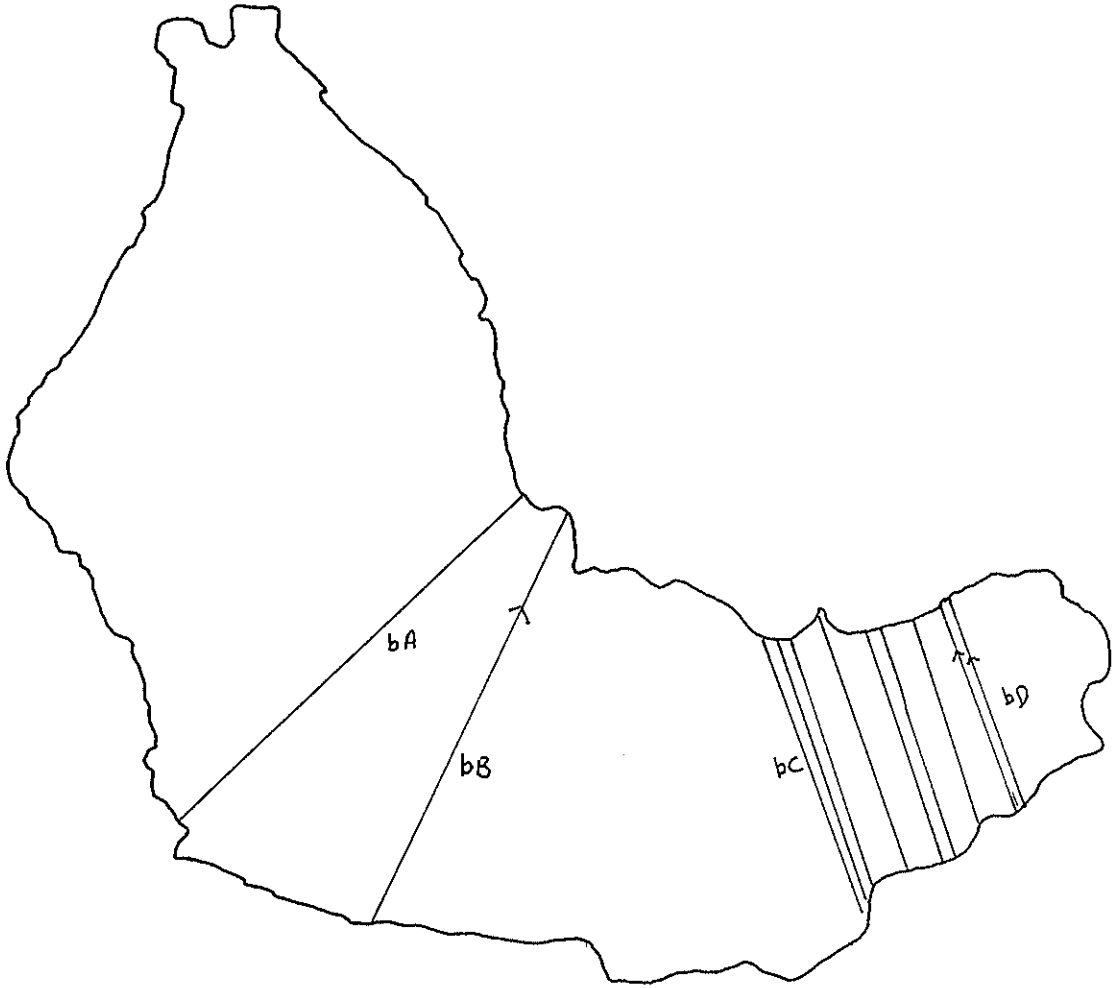
3. This site has also been burnt very frequently and because of its dry nature is very vulnerable to fire damage.

4. It also is surrounded by large areas of cut-away and because of its linear shape restoration procedures would have to be extensive.

There is a more easterly site, Ballynafagh bog, which is much wetter and where restoration measures would appear to be easier. Therefore, as there is an alternative site and the ecological value of this site is limited and restoration difficult it has a low priority for conservation. Owing to these factors the site was not visited by the hydrological section of this project.

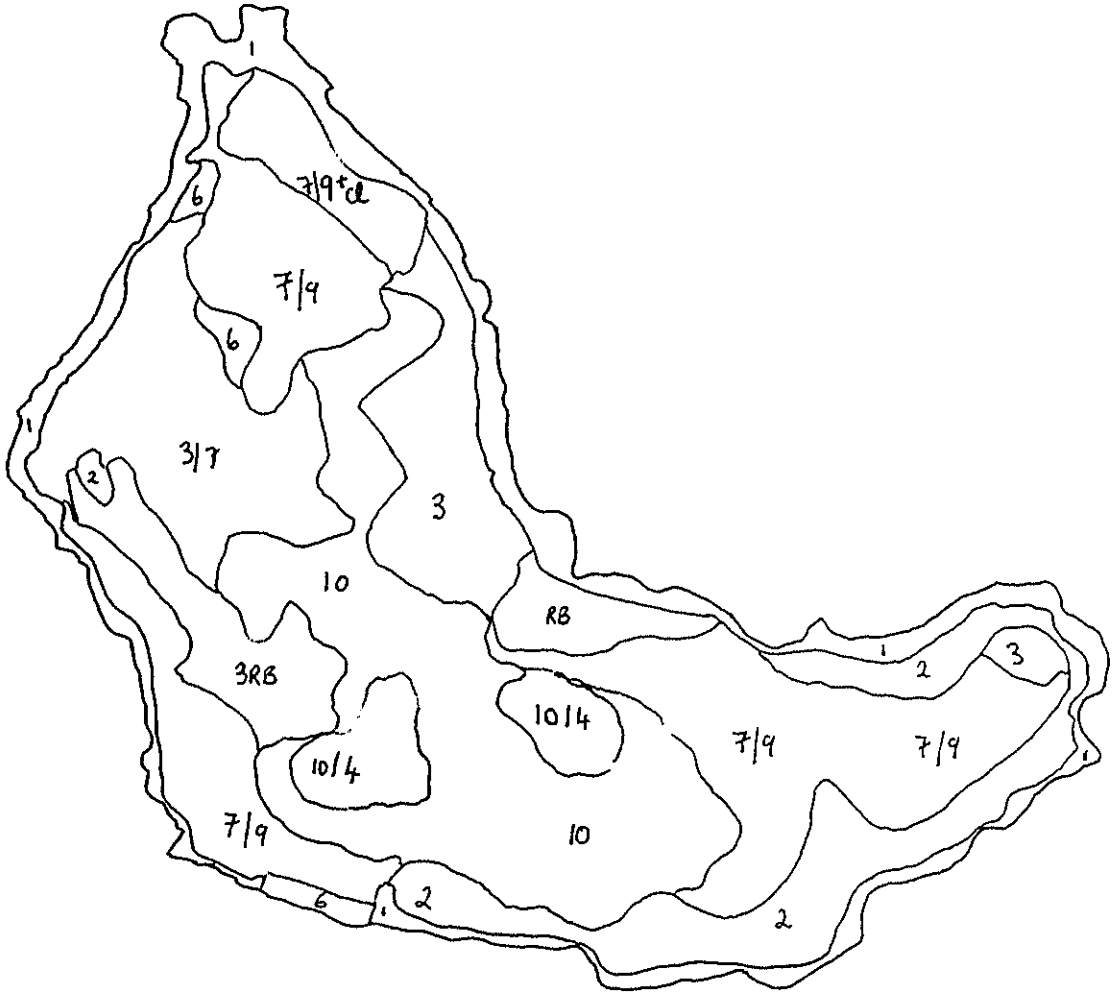
Lara Kelly
Malcolm Doak
Marie Dromey

Raised Bog Restoration Project (1995).



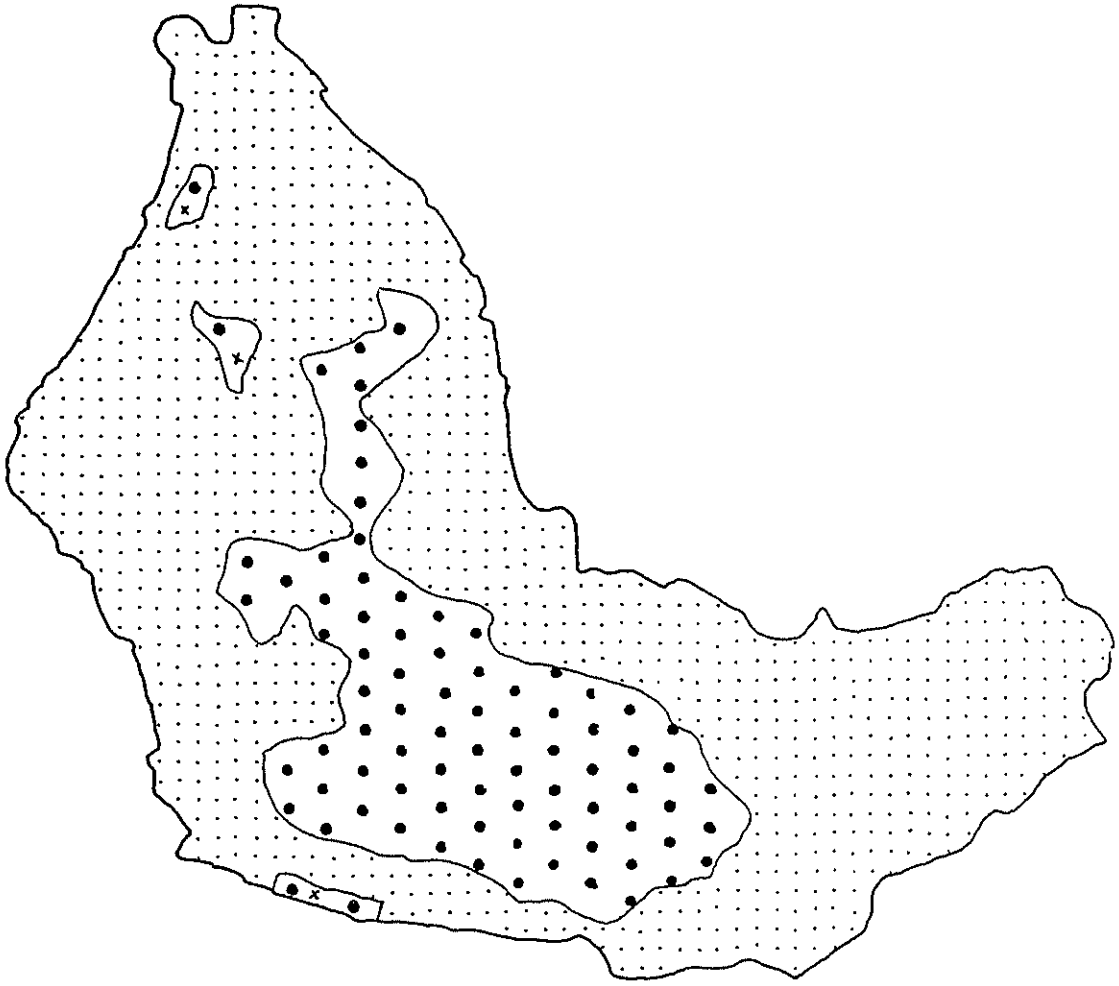
BLACKCASTLE BOG, CO. OFFALY (570).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994

N



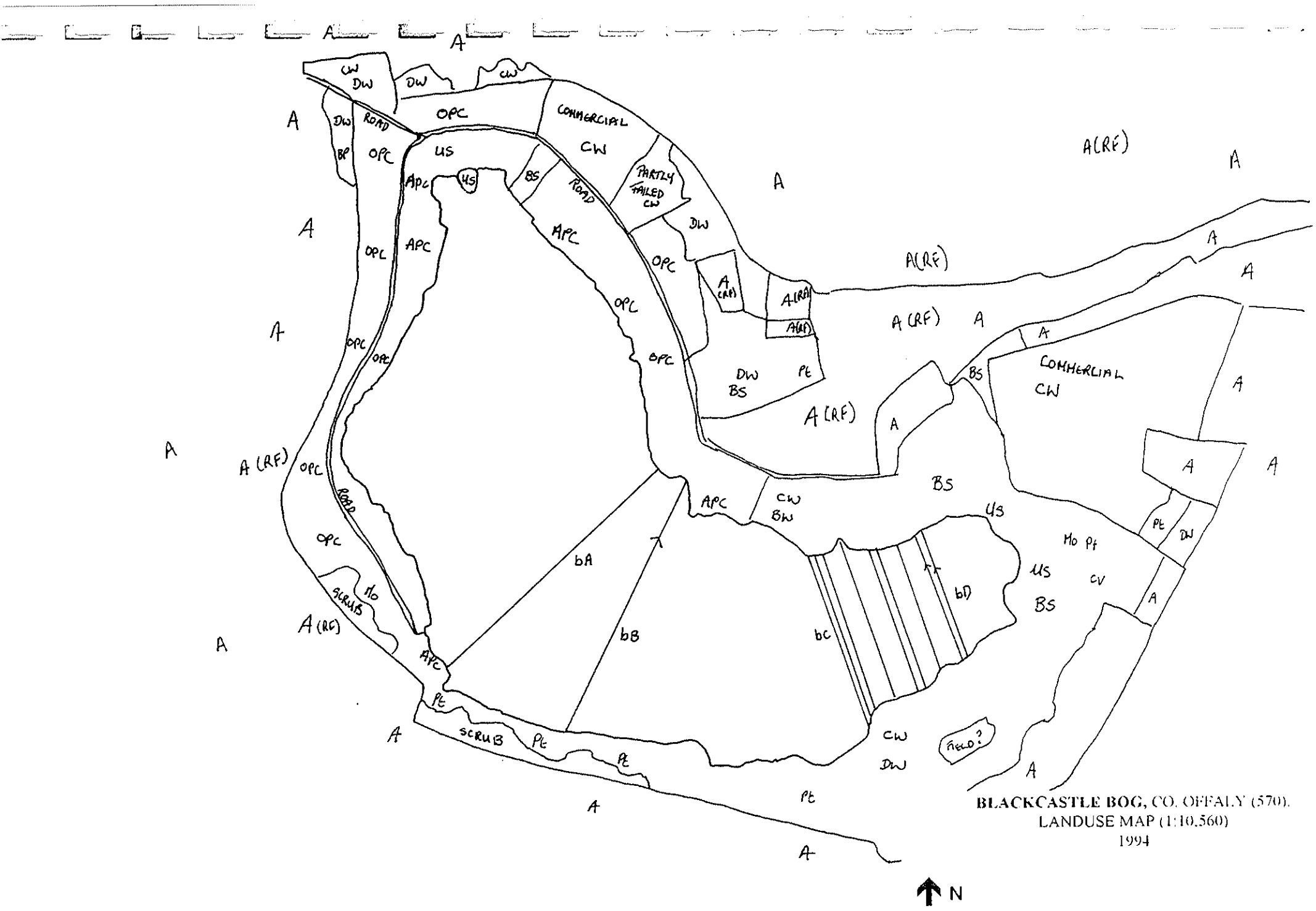
BLACKCASTLE BOG, CO. OFFALY (570).
VEGETATION MAP (1:10,560)
1994

N



BLACKCASTLE BOG, CO. OFFALY (570).
ECOTOPE MAP (1:10,560)
1994

N



BLACKCASTLE BOG, CO. OFFALY (570).
LANDUSE MAP (1:10,560)
1994

BROWN BOG, CO. LONGFORD

1. SUMMARY OF SITE DETAILS

NHA No.	442	1/2" Sheet:	12
Grid Ref:	N 09 76	6" Sheet:	LD 13
GSI Aerial Photo:	N 23	1:25,000 Sheet:	20/27SW
Other Photo:	OS (B/W 1993) 1188	Area (ha):	51.0 (High Bog)
Date(s) of Visit:	27-4-94 (Ecology) (Geohydrology)		

Townlands: Tully, Fihoges, Catronlebagh, Mullolagher, Lissanurland and Brown Bog.

2. INTRODUCTION

2.1 BACKGROUND

This site was visited by Douglas and Grogan (1986) on behalf of FWS. They found that although small this bog featured a flush system with a surrounding large area of extensive quaking carpets of a diverse range of both *Sphagnum* lawn species and lichens on drier areas. A network of pools in the north central area was also noted. It was therefore included in the list of raised bog sites to form part of a conservation network (Cross, 1990). Cross (op. cit.) describes it as a bog which is confined to a small basin with a wet centre from which there may have been a peat flow. A well developed pool/hummock/hollow system was still present. A study of recent aerial photography (OS 1993) revealed that the bog did not appear to have suffered any major damaging effects and that the margins were intact with scrub/woodland surrounding approximately 80% of the site.

Only four relatively intact raised bog sites were listed for Longford, (Cross, 1990) however one of these has subsequently been exploited (Clontymullen). Brown Bog is therefore one of the three most northerly of the midland raised bogs remaining. If restoration procedures are to go ahead on this bog it would ensure the preservation of the N/S gradient variation in raised bogs.

2.2 LOCATION AND ACCESS

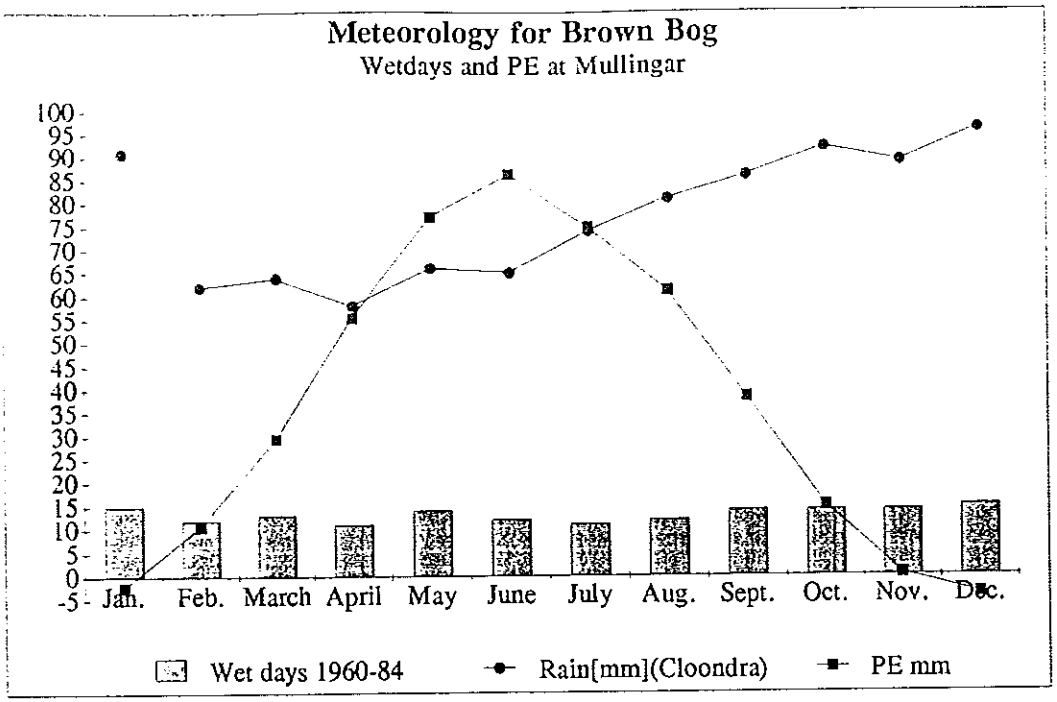
This bog is located approximately 5km north-west of Longford town. It is one of the group of three northern Midland raised bogs. The T 77 road runs close to the southern edge. The bog is accessed from the Longford to Cloondara road (T77). A right turn off the main road takes one onto a grassy track where a car may be parked or alternatively a car could be parked on the main road. This track bends around to the right and you have to push through some *Ulex* scrub on the left to get onto the southern side of the site. The drain here is not deep.

3. METEOROLOGY

No meteorological measurements have been made on Brown Bog. Rainfall data from the Cloondara rainfall station to the W, for the years 1951-80 indicate that the area receives an average 923mm of precipitation annually (Fig. 7). The nearest Meteorological Service synoptic station is to the SE, at Mullingar.

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

Figure 7:



The above factors suggest that the year round actual evapotranspiration (AE) from Brown Bog is greater than PE at Mullingar, site of the nearest synoptic station which had an average PE of 442mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Brown Bog would therefore be greater than 442mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 481mm/yr.

Meteorological data for Brown Bog (1951-1981) are summarised below:

Rainfall (P)	923mm/yr
Actual Evapotranspiration, (AE)	>442mm/yr
Potential recharge, (PR)	<481mm/yr
Raindays @ Birr > 0.2mm (annual {1951-80})	218 days

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE BOG

Overall this raised bog is small and oval with a central depression.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

At the macro scale this bog is situated in the River Shannon valley lying outside its floodplain. The bog is surrounded on all sides by higher ground composed of till and bedrock to the west.

5. HYDROLOGY

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by shallow water bioclastic Carboniferous limestones (shown as SHL, on map).
This limestone would generally have a moderate to high permeability, depending on its degree of karstification and number of fissures. The SHL limestones are generally classed as a locally moderately productive aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability
No subsoils data were available for this bog apart from the 1840s GSI geology field sheets and recent fieldwork carried out for this study.

Geology of Inorganic Subsoils
Generally there was little exposure. Clays and clayey limestone till were noted in the cut-away areas to the SW.

5.1.3 Depth to Bedrock

Depth to rock on the bog is unknown although subsoil deposits are suspected to be <1m deep to the west since there is outcrop here.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology

There are no high bog drains on this site.

5.2.2 Bog Margin Hydrology and Hydrochemistry

There are only two sets of drains in the margins of this bog, both are in the cut-away.

(i) A minor drain runs from the old faces to the cars along the grassy access lane. The EC decreased approaching the bog from 150µS/cm to 92µS/cm. The drain is 2m wide and is infilled with species such as *Nasturtium officinale, Galium palustre, Callitriche sp., Berula erecta, Mentha aquatica* and *Potentilla palustris*. There was no water flow but the standing water was approximately 50cm deep.

(ii) There are some drains in the SW behind the farm in the cut-away but not at the faces. They form a rectangle and are 1m x 1m with ECs of ~40µS/cm.

5.2.3 Laboratory Hydrochemistry

A sample for hydrochemical analysis was taken from Flush Z during the field visit. The results from this suggest that there is a dilute ground water influence at one point in this flush. Ca was 3.22 mg/l, Fe 0.63 mg/l, Mn 0.35 mg/l, NH4-N 0.08 mg/l and pH 5.6.

5.3 GEOHYDROLOGICAL OVERVIEW

Regional Situation
This bog lies within a regional groundwater discharge zone on a valley floor between the Camlin River and the Fallan River.

Subsoils are thick and are generally of low permeability.

Bog Regime
There are just two drains in the cut-away of this bog and there are none on the high bog.

Inter-relationship
The bog probably initiated in a small lake that had no outlet since the bog is surrounded by high ground, some of it bedrock. The water-table is thought to be below surface and run-off from the bog and adjacent mineral soils infiltrates to the margins.

Laggs (fens) may have occurred at one stage around one or both margins of the basin both there is no evidence presently since old cutting has removed it.

6. VEGETATION

6.1 VEGETATION SUMMARY

This site is characterised by a central wet depression with quaking mats of *Sphagnum* and *Narthecium* with *S. cuspidatum* and algal tear pools. Surrounding this area there is a drier version with a lower *Sphagnum* cover and a higher number of the tear pools are algal. *Carex panicea* was abundant over most of the site apart from the central area where the frequency dropped. *Andromeda* was plentiful especially on the hummocks. *Sphagnum* cover is good in the central area (80%) but *S. imbricatum* was uncommon and only one *S. fuscum* hummock was noted. The edges are rather dry with abundant *Calluna*. The lichen cover over most of the site is high ranging from 40 -80%.

The cut-aways are all old and are mainly colonised by *Ulex, Betula, Molinia, Pinus* and *Pteridium*. Along the northern edge old coniferous woodland is seen, consisting mainly of *Pinus sylvestris*. Some parts were very dry with the addition of species such as *Rubus, Crataegus monogyna, Lonicera* and *Epilobium angustifolium*. A wetter area to the mid-west is colonised by *Calluna, Eriophorum vaginatum* and small amounts of *Ulex* and *Molinia* (PM3:35 to SW).

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1
This is found at the mid-west and east edges of the site. *Calluna* is the dominant species. For the remainder of the face bank edges *Ulex* or a combined Complex 1 dominate.

Complex 1/2 + *Cladonia* (*Cl*) + Pine
This complex is seen at the north-eastern (associated with Slopes 5 and 6) and south-western sections of the bog. It is a very dry area dominated by tall *Calluna* (40cm), *Trichophorum* and algal hollows (10%) with many *Pinus sylvestris* and *Betula* seedlings encroaching (P16:31 to NW). The *Cladonia* cover is high (80%). At the south-west there are a number of erosion channels which extend approximately 30 m into the bog and there is a significant flow of water to the SSW.

Complex 1/3
To the north of the site there is a small area of marginal vegetation dominated by *Calluna* and *Carex panicea* with a lot of *Pinus sylvestris*. The terrain is rough and slippy with the *Carex panicea* mainly seen in erosion channels (PL6:35 to NE). There are also some small pools. This complex is associated with Slope 10.

Complex 1/3 + *Cladonia* (Cl)
This complex can be seen at the northern edge west of a band of *Molinia* which leads from Flush Z and is associated with Slope 9. There is 60% *Cladonia* cover. It is dominated by *Calluna* with the addition of *Potentilla erecta* and *Succisa pratensis*. The *Sphagnum* cover consists mainly of *Sphagnum capillifolium* which forms distinct hummocks in this area (PM3:33 and PL6:36).

Complex 2/3/4/6
This is a small area to the south-west with *Trichophorum, Narthecium, R. alba* and *Carex panicea*. The *R. alba* is confined to erosion channels. The *Sphagnum* cover is low (10%). The bog surface undulates in this area and there is no acrotelm (PL6:36 to S and PM3:36 to N).

Complex 2/3/6
This is a small area associated with Slope 3 on the mid-eastern side. It is dominated by *Cladonia* (80%). There is very little *Calluna* (typical hummocks 10%). There are some tall, wide and dry hummocks in this area with species such as *Vaccinium oxycoccus, Andromeda, Polytrichum commune* and *Leucobryum* PL6:29). The boundary between this complex and complex 6/3 is apparent in the field (PL6:28 to N).

Complex 7/4
Located at the NW edge of the site. It is dominated by *Calluna* with *R. alba* erosion channels. The *Sphagnum* cover occurs in isolated hummocks. *Betula, Pinus* and *Rhododendron* were noted. The complex is associated with Slope 11.

Sub-Marginal Complexes
Complex 6 + *Cladonia* (*Cl*)
This is a linear area which runs along the outside of complex 15+Cl. It is dry and is dominated by *Narthecium*. The *Sphagnum* and *Cladonia* cover are much reduced. A bush of *Ulex* occurs on the high bog at the boundary of this complex and complex 15+Cl. There is another patch to the SW of the site.

Complex 6/3+*Cladonia* (Cl)
This is the sub-marginal to sub-central complex of this site. It is located on the more gradual slopes. It is dominated by *Narthecium* and *Carex panicea* with patches of *Huperzia*. The *Sphagnum* cover is moderate (25%). The *Calluna* is tall with some high hummocks of *Leucobryum* and *S. imbricatum* with *Dicranum scoparium* occurring. *Sphagnum subnitens* had a noticeably higher occurrence than on the other sites in this region. The *Cladonia* cover is 40%. The acrotelm is variable with some soft and hard areas. At the SE edge this complex extends to the margin but with the addition of *Molinia* (70 m in from edge in places) and *Ulex* encroaching. On the western slopes of the site the *Carex panicea* element of this complex occurs in erosion channels leading to the bog edge. There is an increase in *R. alba* in this area also. Where this complex occurs to the NW of the site it is associated with Slope 12 and to the E with Slopes 2 and 3.

Complex 6/3 + Tear Pools + *Cladonia* (TP+*Cl*)
This is similar to the 6/3 complex but with the addition of tear pools. It occurs on the outer edges of complex 15+Cl and in a small area to the SE. The *Sphagnum* cover is 30% and there are 10% of *Sphagnum* cuspidatum pools with some *Sphagnum auriculatum* but the same percentage are algal (PL6:26 to ENE shows tear pools). The *Cladonia* cover is high in this area (40%). This complex appears to be associated with slumping of the bog. Where it occurs on the SE side it is closely associated with the steep slope to the bog edge and the sloping into the centre of the site. (*Sphagnum* x collected). Some large occur, one was colonised by *Empetrum nigrum, Eriophorum vaginatum* and lichens (PL6:32). Some *Pinus sylvestris* and *Betula* seedlings were seen in this complex.

Central Complex
Complex 15 +*Cladonia* (Cl)
This is the central vegetation complex of this site and is located in a depression in the mid-northern part of the bog (Slopes 7 and 8). The *Sphagnum* cover is high (80%) and consists mainly of *S. capillifolium* with *S. magellanicum, S. papillosum* and *S. cuspidatum*. *Cladonia* cover is also high at 50%. Pools are frequent (35%) many containing *S. cuspidatum, S. auriculatum, Menyanthes* with

Drosera anglica, Rhynchospora alba and also *D. intermedia*. Many pools only contained small amounts of *S. cuspidatum* and were filled with algae or were bare. One pool also contained *Riccardia sinuata* with abundant *Menyanthes* (water sample collected). The pools are mostly linear reflecting a tearing pattern. They are aligned E/W in the centre but the alignment changes towards the edges where it is in a N/S direction. Some of the pools are very deep. At the edges of some of the pools *Aulacomnium palustre* was dominating (PL6:33 and PM3:29). The inter-pool areas are quaking with a high abundance of *Narthecium* flats. *Sphagnum imbricatum* hummocks occurred in this complex. On some of the larger hummocks *Betula* seedlings were growing.

6.2.2 Flushes

Flush Z is associated with Complex 15+Cl (PM3:32) and is seen in the northern side of this depressed area. *Betula* trees and scrub are scattered throughout this area. Patches of *Juncus effusus* were also recorded. Quaking *Narthecium* flats and *Sphagnum* lawns dominated the inter-pool areas (PM3:31). One pool with obvious water flow supported *Potamogeton polygonifolius* (EC 60 µS/cm). A water sample was taken at this point for analysis (see Section 5.2.3). There were a high number of tear pools which at the northern side have a distinctly N/S orientation and a significant water flow was seen in these sometimes disappearing underground and re-appearing in the next pool. This flow was followed to the bog edge and could be seen flowing into the marginal drain in the cut-away on the northern edge (PM3:31 to E and 32 to S and PL6:34 to W). There is a distinct ridge surrounding this area. A *Molinia* dominated tract leads from this flush towards the NNE.

7. BOG TYPE

This bog has been classified as a Basin bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes

The slopes of this small bog are quite steep especially at three edges - N, E and W. However there is no active peat cutting carried on around the bog. The wettest vegetation complex is located in a depressed area. A number of slopes were estimated in the field. These are described below and are illustrated on the Slopes Map.

Slope 1	Towards the cut-away at the southern edge of the site the slope is 3.5m over 200m through Complex 6/3 +Cl and a recently burnt area (PL6:25). There is some cracking of the bog surface in this area.
Slope 2	At the south eastern edge the slope into very old cut-away and fields is very gradual, 0.75m over 300m.
Slope 3	At the eastern edge where peat cutting extended further into the bog in the past and where there may have been a connection with other bogs which have now been cut-away there is a steep slope, 3m over 50m (PL6:28).
Slope 4	Associated with the same area of cut-away but at the northern side of it there is a very steep slope of 2m over 20m.
Slope 5	At the eastern side of the northern margin there is a slope into old cut-away of 1m over 20 metres.
Slope 6	Further west on the same margin the slope decreases to 1.5m over 50m.
Slope 7 & 8	The central complex 15+Cl is located in a depressed area at the north central part of the bog. On both sides of this area the bog slopes upwards by about 0.5m over 100m (PM3: 31 and 32).
Slope 9	In the centre of the northern boundary the slope from the south is more gradual 2m over 75m.
Slope 10	In the same area the slope from the east to the edge of the bog is 4m over 75m.
Slope 11	In complex 7/4 at the NW the slope is gradual 1m over 100m.

Slope 12 In Complex 6/3 further to the south along the W side the slope is steeper 2m over 75m. It is associated with an area of old peat cutting (PM3:35 to SW) .

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

At the time the ecologists visited the site there was no active peat cutting. The cut-aways have been abandoned for some time and scrub has developed. In areas where old peat cutting extended further into the bog rather than around it, significant slumping and steep slope development have resulted. Most of the cut-aways appear dry but an area to the south (which had been recently burnt) had a wet area next to the old face bank, which was colonised by *Molinia, Juncus effusus, Ulex, Betula, S. cuspidatum, S. papillosum* and *S. capillifolium*. The old face bank in this SW area is 1.5 metres high.

In June 1994 P. O'Donnell (Local Wildlife Ranger) in his NHA notes, states that there is removal of scrub and insertion of drains in preparation for peat cutting to the SW of the site.

P. O'Donnell (Local Wildlife Ranger) in NHA notes says that the I.D.A. tried to interest a commercial concern in producing moss peat at this site. He feels that as other bogs and associated cut-aways are depleted that commercial production at this site may be considered.

8.2.2 Forestry

A large area of cut-away peat to the east of the site has been recently afforested with Sitka spruce.

8.2.3 Fire History

Most of the site has escaped recent burning as the lichen cover is very high in most areas (up to 80%). However an area on the southern edge has been burnt within the last 2 or 3 years. This appears to have originated in the cut-away behind the factory at the SW of the site and has extended approximately 50-75m onto the high bog. *Calluna, Trichophorum, Andromeda and Eriophorum angustifolium* are re-growing. The *Sphagnum* cover has been completely destroyed.

8.2.4 Dumping

Behind the factory at the SW of the site there is a significant amount of dumping.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. There are few drains associated with this site and any that occur are marginal. There is no active peat cutting and the cut-away areas have been colonised by *Betula pubescens, Ulex* and *Pinus sylvestris*. The latter species is encroaching onto the northern and north-eastern edges. This would be a management problem.

2. There is a high habitat diversity due to the flush system and the surrounding tear pool complex. However these are most probably secondary features resulting from a peat flow with subsequent subsidence causing focused water flow.

3. An important point about this bog is that it has not been burnt for some time. Also it is one of the few sites where active *Sphagnum imbricatum* growth has been noted. *S. imbricatum* was seen growing in its lax form at the edge of a pool forming a low hummock. *Drosera intermedia* was also recorded.

To the east of the site there is an area of new coniferous plantations which appear to be planted on peat which may have been part of Brown Bog in the past. However most of the extent of the original peat basin appears to be remaining.

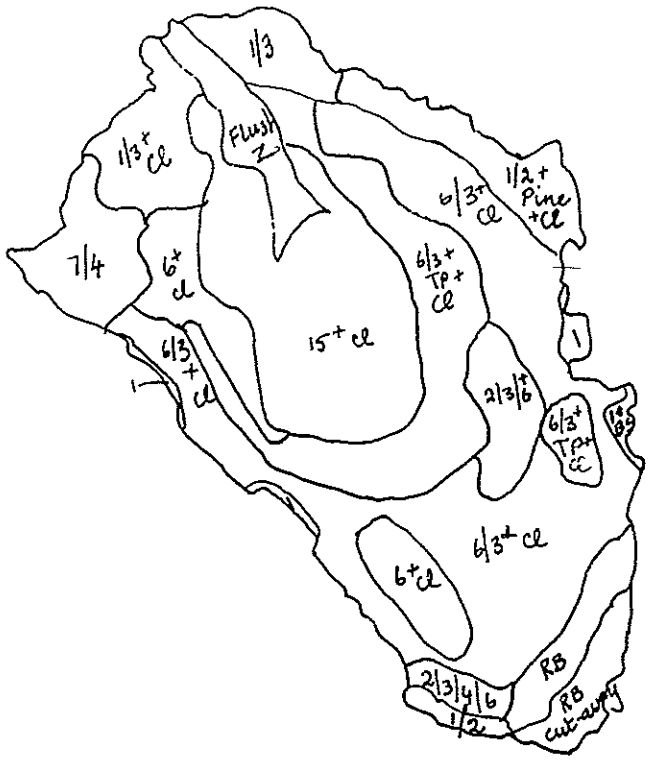
A grouse was seen at this site which is unusual considering its small size.

Lara Kelly
Malcolm Doak
Marie Dromey

Raised Bog Restoration Project (1995).

BROWN BOG, CO. LONGFORD (442).
VEGETATION MAP (1:10,560)
1994

N



BROWN BOG, CO. LONGFORD (442).
ECOTOPE MAP (1:10,560)
1994

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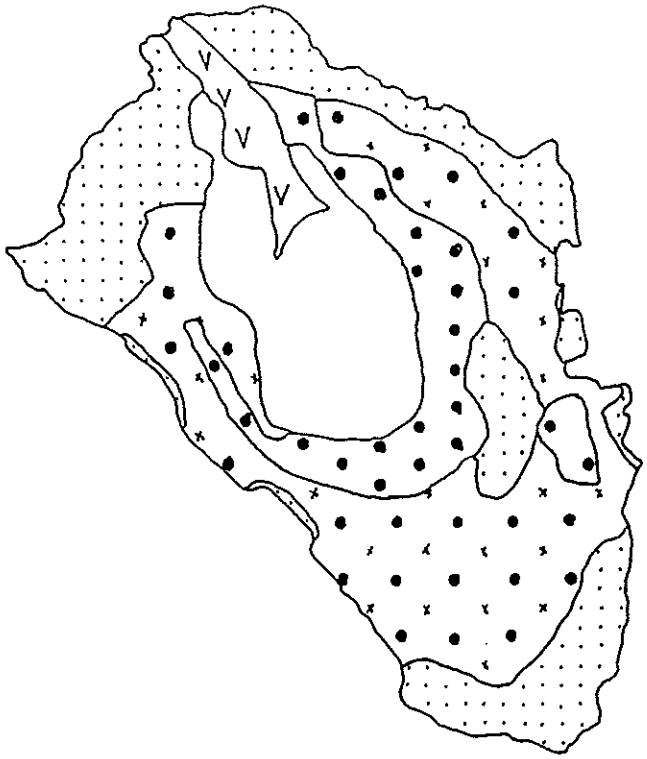
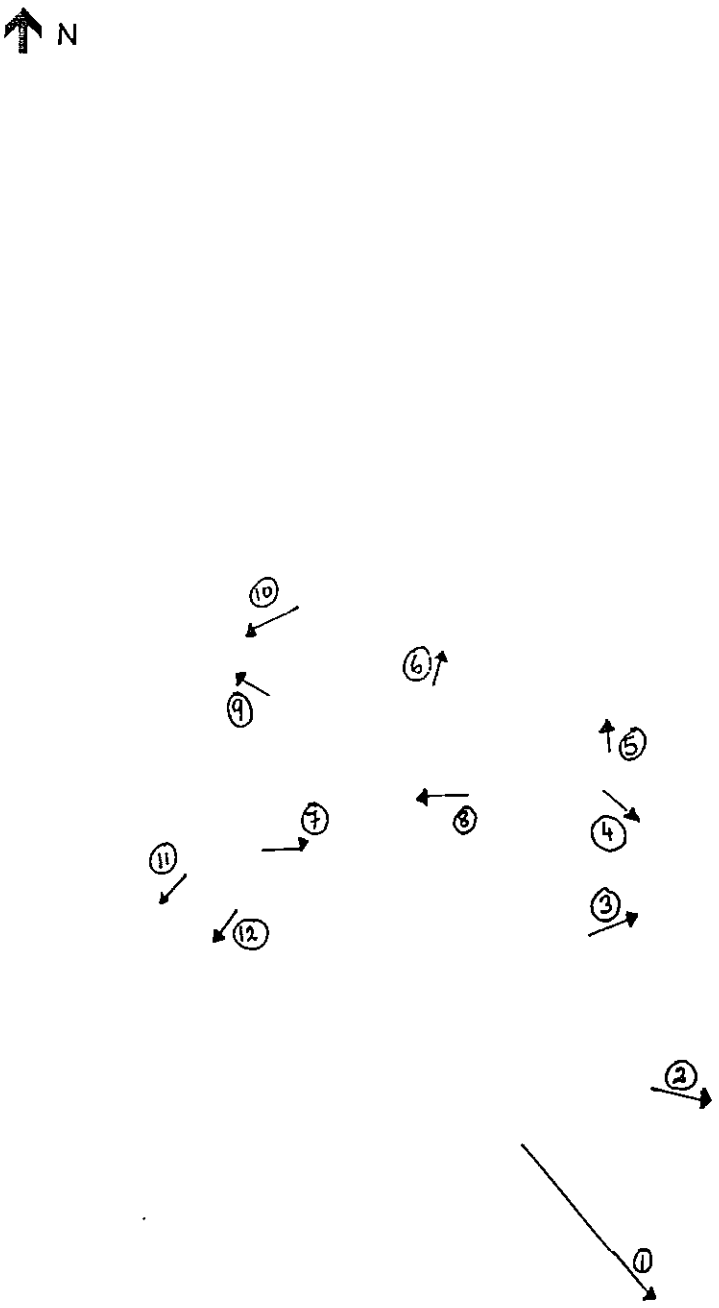
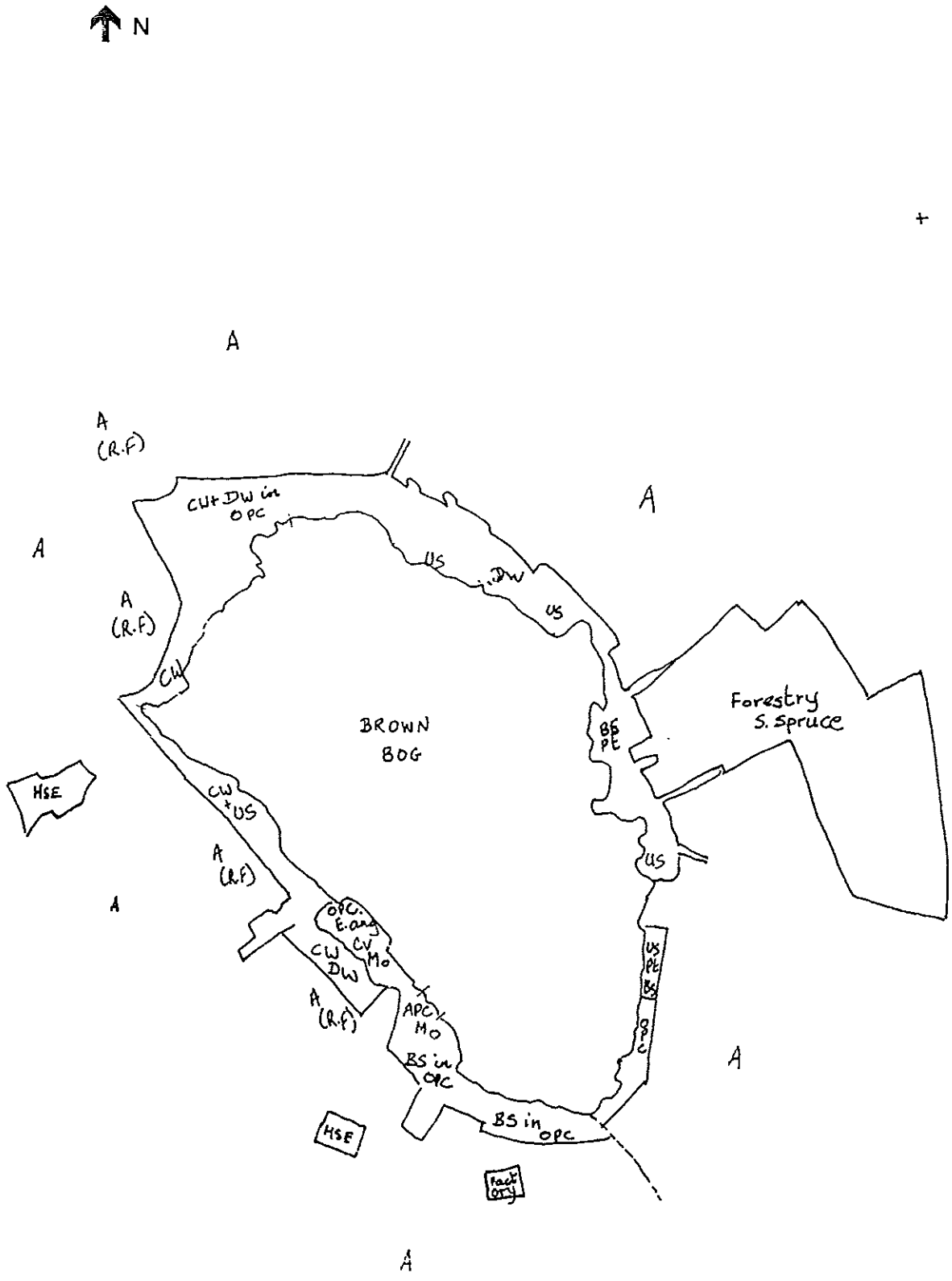


BROWN BOG, CO. LONGFORD (442).
SLOPES MAP (1:10,560)
1994



BROWN BOG, CO. LONGFORD (442).
LANDUSE MAP (1:10,560)
1994



CALLOW, CO. ROSCOMMON

1. SUMMARY OF SITE DETAILS

NHA No.	595	1/2" Sheet:	12
Grid Ref:	M 68 96	6" Sheet:	RN 8
GSI Aerial Photo:	M676	1:25,000 Sheet:	14/29 SE
NHA Photo:	869:1-36	Area (ha):	163 (High Bog)
Date(s) of Visit:	5/10/94 (Ecology) 5/10/94 (Geohydrology)		

Townlands: Callow or Runawillin, Cloonmagunnaun and Keelbanada.

2. INTRODUCTION

2.1 BACKGROUND

Callow bog was visited by Douglas and Mooney (1984). They described it as a large undulating intermediate type bog. Most of the bog had been badly burnt in 1987. *Sphagnum* cover is poor and cyperaceous species dominate. To the NE a series of tear pools were noted. The bog is thought to be a roosting site for Greenland White-fronted geese. It was given Bi status.

This site plus another to the N of the Lung River were included in the NNR net-work list (Cross, 1990). These are known as Callow complex.

Callow is included as part of the Lough Gara Complex NHA.

2.2 LOCATION AND ACCESS

This bog is located on the SW shores of Lough Gara approximately 6km NW of Frenchpark, Co. Roscommon and 4km E of Ballaghadreen. The Lung River and a bog road run along the north. A road runs by the W edge and another by the S. To the E a bog road separates a section of bog (East Lobe) from the main body of the bog (Main Lobe). A small river also runs to the S of the bog.

Access may be gained from the bog road to the N.

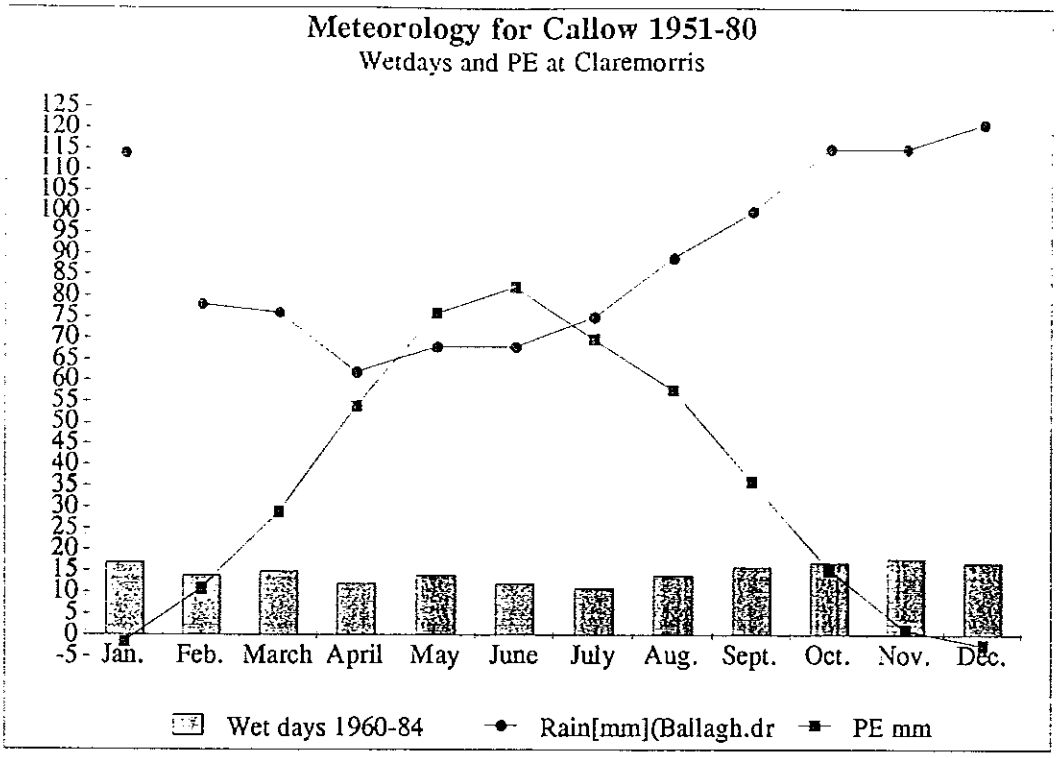
3. METEOROLOGY

No meteorological measurements have been made on Callow bog. Rainfall data from Ballaghadreen rainfall station for the years 1951-80 indicate that the area receives an average 1080mm of precipitation annually (Fig. 8).

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that the year round actual evapotranspiration (AE) from Callow Bog is greater than PE at Claremorris, site of the nearest synoptic station which had an average PE of 428.1mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Callow would therefore be greater than 428.1mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 652mm/yr.
Figure 8:



Meteorological data for Callow Bog (1951-1981) are summarised below:

Rainfall (P)	1080mm/yr
Actual Evapotranspiration, (AE)	>428.1mm/yr
Potential recharge, (PR)	<652mm/yr

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

This bog is relatively flat with slight slopes north to Lough Gara.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

Callow is situated alongside the River Lung and Lough Gara and in a depression NW of a low relief drumlin. The area to the SSW is relatively flat since it is a zone of former peat that has since been cut-away.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Smith, show that the area is probably underlain by cherty argillaceous bioclastic Carboniferous limestones (known as ABL).

The ABL fossiliferous limestones generally have a low permeability and are classed as a poor aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

No subsoils data were available apart from the initial 1840s GSI geology field sheets, and recent fieldwork.

Geology of Inorganic Subsoils
The Quaternary subsoil geology of this bog and surrounding area is dominated by clayey tills/clays. Sections along the Lung River show clays.

5.1.3 Depth to Bedrock
Depth to rock on the bog is unknown.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology (See Drains and Hydrochemistry Map)
There are many old drains associated with peat cutting around much of this site with some new deep drains to the N of the main bog. A track to the E and NE separates part of the bog from the main body and there is a drain along it with further old drains beyond at right angles to it. An old, mostly infilled drain across the centre of the site.

North
Drain bA is along the N edge of the site and there is significant flow to the N to the bog edge. It is old, up to 0.5m wide, has a high water table and is infilling. Immediately to the S of it there is a small very wet area in a depression and Drain bA appears to be draining it.

Drains bB and bB1 are new drains which flow SSE into the new Drain bB2 which is part of Flush Z and is parallel to the N edge and close to it. Drains bB and bB1 are 0.5m wide by 0.25m deep and are bare.

Drain bB2 is new and parallel to the N Bog edge and flows E and W from one swallow-hole to another at the N end of Flush Z and E for a short distance into Drain bB3. The swallow-hole to the E has been deepened and widened up to 3m. The drain is up to 1m wide in places.

Drain Complex bD is at the N of the site and consists of 8 drains which are aligned N/S and a link drain (Drain bD) at the S end of them which extends from a swallow-hole at the W of Flush Z to another of Flush Y. Slope 3 is associated with this E/W drain - Drain bD from its junction with bD5 to the west. This drain is 0.75m deep and wide with 5cm of water flowing W into the swallow-hole (PM18:9). At the E end and on a slope associated with Flush Y the flow is to the east. The drain is bare.

Drains bD2 - bD8 are aligned N/S and flow N at the N end. They are up to 6m wide at the N end and old peat cutting has been carried out along them. There are some newer drains alongside them but these are not described. The banks along parts of the drains have collapsed. The S end of the drains is much narrower. There is a high water table in Drain bD5. There is a patch of *Phragmites* at the junction of Drains bD5 and bD and also along Drains bD5 and bD6. The peat cutting along Drains bD6-bD8 is active and extensive with the facebanks in bD6 up to 1.5m.

Un-named drains along the northern edge. There are very many old drains along this and the NW edge which are associated with active and old peat cutting. The peat cutting is carried out along them and they are quite wide with collapsed banks, stagnant pits and channels with some flow. There is much *Calluna* in the vicinity.

North of the track there are some old non-functional drains most of which have had peat cutting carried out along them. There is some active Difco along one of the drains to the W of this area.

Drains bE are drains which occur along the edges of the bog road which divides the Main Lobe from the E Lobe. Water from peat cutting banks flows into these drains in places.

East
There are some deep old drains to the east of the site east of the track and no peat cutting has been carried out along them. They are up to 1.5m deep with some flow to the E. Drains at the SE of the site are mainly old hand cutting banks now with Difco cutting along their edges.

Centre
Drain bH is an old drain which runs NW/SE through the centre of the site to the SW. It follows a townland boundary shown on the 1910 6" sheet. The drain is mostly infilled. *Molinia* and *Myrica* occur along the drain and spread out from it in places. A *Rhododendron* bush is seen just to the N side of this drain towards the west. Where this drain runs through Flush Z it is not easily seen in the field as it is totally infilled.

South
There are very many drains associated mainly with old peat cutting along this side of the bog. The cutting was carried out along the length of the drains and some of them are up to 6m wide. No new drains were seen on the high bog. There is *Phragmites* and *Molinia* along the edges of some of the drains with *Typha* along the mid south. The EC in the area to the W of this southern edge of the bog varied from 135-380 µS/cm and there was some Fe staining.

West
Again there are many old drains associated with peat cutting. Some new drains have been inserted along this edge. Drain bF is an old double drain which is an extension of an old track and there is significant flow to the SW.

Drain Complex bG consists of two long drains more or less parallel and aligned N/S with two connecting smaller drains. The more westerly drain forms part of a townland boundary. The drains are 0.5m deep and wide and there is significant flow to the SW.

5.2.2 Bog Margin Hydrology with Face Bank Details
North
The north side of this bog lies alongside the deepened River Lung which flows eastwards into Lough Gara. The north is serviced by a well kept track. There is much old hand cutting along the entire northern section of the bog with many old turf banks where stagnant but sometimes interconnected pools remain. Flow from these extensive areas of cutting moves north to the trackway. Water from the track discharges to the River Lung via two main outlets at mA and mB. There is grass covered clayey till on the banks of the River Lung with exposed sections of calcareous shell marl.

There are several swallow holes in the high bog 150m to the south of the track at drains bB2. The drain at bB1, has been deepened. Three drains flow south into the swallow holes. Two of these drains (bB, bB1) also move water north into the cut-away. Drain bB has been damned half way so as to direct flow north to the cut-away via a 1.5m deep and 1m wide old hand cut channel.

North East
Faces extend to the north side of the track and lie alongside the shores of Lough Gara. The faces are 3-4m high. Slight clay covered grass slopes lie between the lake and the peat. There are wet pools in the grass areas at a higher level than the lake along the break in slope. Groundwater is seeping/upwelling at theses points.

South East
This area is marked by localised hopper-cutting and old hand-cut faces. *Typha* and *Phragmities* grow in the cut-away areas. The drains mE on either side of the southern track are 1.5m wide and > 1m deep with strong flows to the east.

South
This zone is marked by a large cut-away area with stagnant pockets of water.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map)

Water flowing from the bog and the adjacent inorganic subsoil was sampled on the 5th October 1994.

North

EC along the NNW side of this bog from A1 to A, in the hand cut areas, is no more than 85µS/cm. The main outlet at mH, which flows into the R. Lung has an EC of 68µS/cm. The River Lung has an EC of 450µS/cm. Outlet mB, has an EC of 100µS/cm. There is thought to be no groundwater upwelling in this zone since the ECs are so low; there is only run-off from the high bog.

North East

The electrical conductivity along the grass slopes was > 390µS/cm and the EC of Lough Gara was ~430µS/cm. The ECs along the track (bE) in the NE were <85µS/cm.

South East

Drains mE have ECs of ~185µS/cm.

South

The ECs are <180µS/cm in this area.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation

Callow bog lies in a regional groundwater discharge zone and is situated between a high bedrock cored ridge and Lough Gara. The underlying limestone aquifer has a low permeability and hence the water-table in this area would be relatively close to the surface.

This bog lies in a shallow basin which slopes north east to Lough Gara. The water-table of the area has been lowered due to extensive drainage works in the past.

Bog Regime

There are relatively few drains on the high bog but there are many drains in the cut-away particularly to the south. Generally the ECs were ~150µS/cm in the shallower cut-away drains apart from those in the north east where ECs were >300µS/cm in drains that intercepted the regional water-table along the lake shores. Little runoff from the bog is believed to infiltrate to the watertable since subsoils are generally of low permeability at depth.

Inter-relationship of topography hydrology and hydrogeology

This bog developed in a basin which may have been partly flooded in the past by Lough Gara. Any natural lag zones have been cut-away apart from the northern side along the shores of Lough Gara.

6. VEGETATION

6.1 VEGETATION SUMMARY

Narthecium is an important species at this site being the dominant species in many of the complexes. *Carex panicea* is also important. Only two wet areas with pools occur, one to the E and the other to the S of the Main Lobe. Pools are quite well developed at the S with *Carex limosa* seen in some. However these pools are probably as a result of stresses induced by peat cutting and drainage. *Sphagnum* cover is typically quite low but does reach up to 30 or 40% in places. *S. capillifolium* and *S. papillosum* are the most frequent species.

The western indicators *Racomitrium* and *Pedicularis sylvatica* were seen commonly around the site and *Pleurozia purpurea* was also noted. *S. magellanicum* was almost lacking though *Andromeda* was recorded.

Two *Molinia* dominated flushes occur at this site. One covers a large section of the centre of the Main Lobe while the other is a smaller linear feature with swallow holes to the NE. The large flush is probably associated with an underlying mineral mound. *Phragmites* is seen on the highest point of the mound.

The vegetation of the cut-aways is dominated by *Calluna* on old turf banks and along collapsed facebanks. There are stagnant pits in some of the older cut-aways and some regeneration peat. To the SSE of the site there is much *Phragmites, Molinia* and *Typha* in the cut-aways with the EC varying from 150-380 µS/cm. Beyond the old drains along which the peat cutting was carried out there are flat areas dominated by *Molinia* and *J. effusus*. There is a very small amount of scattered, short *Ulex* and *Salix* in the cut-aways. Where there is Difco cutting, especially to the N of the high bog, the vegetation, dominated by *R. alba*, reflects the disturbance. There is also much bare peat. At the NW corner of the site some *Betula, Ulex* and *Myrica* are encroaching onto the high bog. There are old tracks quite close to the high bog and these support calcareous species and are lined with *Pteridium*, short *Salix* and *Ulex* and *Molinia* with some *V. myrtillus* to the NE.

Where the bog is bounded by Lough Gara there is a sharp transition from bog to grazed wet meadow at the NW and the facebanks are up to 2.5m tall. There is some peat cutting but for the most part the bog edge is lined with a narrow band of *Alnus glutinosa, Crataegus, Salix, Rubus, Vaccinium myrtillus* and *Pteridium* (PM18:11+12). Further E along the edge the facebanks are lower (PM18:14). The edge is dominated by *Pteridium* with some *Ulex*, short *Salix, Molinia* and *V. myrtillus*. At the very ESE edge the facebanks are less than 1m high and they grade into wet meadow.

In the area between the lake and the bog there is grazed wet meadow/fen which floods during the winter (PM10:11+14). Species seen to the NW of this area include *Juncus effusus, J. conglomeratus, Iris, Agrostis, Caltha palustris* and some *E. angustifolium*. There is a band *Ulex* parallel, to the lake shore in this area. Beyond is the flood plain with exposed lichen covered rocks. To the ENE and E of the site there is a band of wet meadow dominated by *J. effusus* and *Succisa* with *Hydrocotyle, Carex rostrata, Ranunculus flammula, R. repens, R. acris, Iris, Epilobium palustre, Valerian, Lythrum, Angelica, Mentha, Caltha palustris, Carex echinata, Rumex, J. articulatus, E. angustifolium* and *Anthoxanthum*. This ground slopes down to the lake. Beyond this is a large band of *Phragmites* with some *Typha* (PM18:14).

To the S of the E Lobe a small river runs E into Lough Gara. The river banks are dominated by *Juncus effusus*, sedges and grasses. *Iris* and *Glyceria* were noted in the river (EC 190 µS/cm).

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

This *Calluna* dominated complex is seen all along the edges of the road which divides the Main Lobe from the E Lobe. It is also seen along some of the drains at the SE of the site.

Complex 2/3

This complex is seen close to the N edge on either side of the exit of Flush Z. *Trichophorum* and *Carex panicea* dominate. The *Sphagnum* cover is low and the bog surface is hard. These areas were probably burnt in the past.

Complex 3 and 3 Recently Burnt (RB)

Carex panicea dominates these two complexes. 3RB is seen for some distance along the SSW edge of the bog. There is active peat cutting along part of this area and there is some bare peat. To the SE of the Main Lobe there is an area of vegetation dominated by *Carex panicea* which has not been recently burnt. It is associated with active peat eutting. *Sphagnum* cover is low in both and the bog surface is hard underfoot.

Complex 3/2

This is seen in a very small patch at the N edge E of the exit of Flush Y in an area where active peat cutting is carried out. The ground is very hard and dominated by *C. panicea* and *Trichophorum* with bare peat. It is also seen to the W corner of the bog in an area where Difco cutting is carried out.

Complex 3/7

This is seen to the SW of the site in an area which is drying out due to the insertion of new drains. It has also probably been burnt some time in the past. The complex is dominated by *C. panicea* and moderately tall *Calluna.*

Complex 3/2/6

Carex panicea, Trichophorum and *Narthecium* dominate this complex with *E. vaginatum* also abundant. There is very little *Sphagnum* cover (5%) and the bog surface is very hard. Occasional low degraded hummocks are seen but mostly the micro-topography is very uniform. The area was probably burnt between 5 and 8 years ago. *Calluna* is approximately 15cm tall. The terrain is rough and slippy. It is seen towards the W of the Main Lobe where there is a moderate cover of *Cladonia* and at the SE end of the E Lobe.

Complex 3/2/7 +*Myrica* (My)

This complex is seen between the main body of Flush Z and its eastern arm. *Carex panicea, Trichophorum* and *Calluna* dominate with scattered *Myrica*. The ground is not soft.

Complex 3/6

This is closely associated with Complex 6/3 and is seen to the N of the site E of Flush Y exit. It is dominated by *C. panicea* and *Narthecium* with some *Trichophorum* and bare peat. It is associated with the slope at the edge of the bog and with peat cutting. The ground is hard and there are patches of surface water and *R. alba*. There is another area of the complex to the SW edge of the bog. A burnt version of the complex is seen beside it (Complex 3/6RB). There is active peat cutting associated with both these complexes.

Complex 3/6RB Recently Burnt

This complex is seen to the SW of the site where a recent fire has resulted in a dominance by *C. panicea* with *Narthecium*. The area is associated with active peat cutting by the Hopper method.

Complex 3/6+ *Cladonia* (*Cl*)

This is associated with Complex 6/3+*Cl* seen to the W of the E lobe and is similar to it with a reversal of the dominants and some bare peat. This version is seen at the edges and along the areas where old peat cutting has been carried out.

Complex 9/7
This is seen at the S end of the E Lobe. *Calluna* and *E. vaginatum* dominate with some *Myrica* also present close to the river. This area has been severely poached by cattle and the surface is very hard and tussoeky. It is seen close to the small river which bounds the S of the E Lobe.

Complex 9/7 + *Cladonia* (*Cl*)
A very small area of this complex is seen in the middle of the E lobe sandwiched between Complexes 6/3 + and 6/9+. The *Calluna* is tall and there is much *E. vaginatum*.

Complex 9/7/6
This is seen close to the SE edge and is dominated by concentrated patches of *E. angustifolium*, *Calluna* and *Narthecium*. There are some algal hollows with *R. alba*. Large low *S. imbricatum* hummocks are seen.

Complex 7/9
This is seen in the middle of the E lobe and is dominated by *Calluna* up to 50cm tall and *E. vaginatum* (PM18:14) with some enrichment indicators. This complex is associated with Slope 6 and an area of old peat cutting.

Complex 6/9+ *Cladonia* (*Cl*)
This is seen in the mid section of the E lobe and the *Cladonia* cover is 15%. The complex is dominated by *Narthecium* and *E. vaginatum* with *Calluna* 20% and up to 50cm tall. There are some tall *S. capillifolium* hummocks and *Pleurozium schreberi*. A very small degree of poaching occurs at the very NE edge of this complex.

Complex 9A
Between the strip of *Molinia* at the SE of Flush Z and Complex 6/3+Pools+*Cladonia* there is a patch of vegetation dominated by *E. angustifolium*.

Complex 3/9A
This area is dominated by *Carex panicea* (35%) with a lot of *E. angustifolium* (30%) with some *Narthecium* (10%) and *Trichophorum* (5-10%). There is much surface water and many shallow algal pools. There is very little *Sphagnum* and under the surface water layer the ground is hard. It is seen to the NW of the bog on a slight slope to the NNE.

Complex 3/6/7+*Molinia* (Mo)
This is seen to the NNE of the Main Lobe. *Carex panicea, Narthecium* and *Calluna* are frequent with scattered *Molinia*. The presence of *Molinia, Vaccinium myrtillus* and *Aulacomnium* suggests some enrichment. A *Rhododendron* seedling was noted in this area.

Complex 6/9A/3
This is very similar to Complex 3/9A except that *Narthecium* has a higher cover. It is seen to the W of Flush Z.

Complex 6/9/7
This is seen on the E Lobe. *Narthecium, E. vaginatum* and *Calluna* are important. There is very little *Sphagnum* cover but *S. magellanicum* was noted. The bog surface is very hard here.

Complex 6/3/2
This occurs at the SE corner of the Main Lobe, along the SE edge where slope factor exerts an influence and to the SW and W of Flush Z. *Narthecium* dominates with *Carex panicea* and *Trichophorum*. Some *S. capillifolium* hummocks are present but otherwise Sphagna are more or less absent and the bog surface is hard. To the E this complex has probably been fairly recently burnt as the *Calluna* is very short and *Campylopus introflexus* and *Cladonia floerkeana* are present. Where the complex occurs along the SE edge the *Trichophorum* increases towards the edge. There are some areas where *C. panicea* dominates and in others there is tall *Calluna*.

Complexes 4/6, 4/2B and 2/4/6B (Burnt)
These complexes are seen to the N of the site in an area where recent burning has taken place, where new drains have been inserted and active Difco cutting is carried out. There is much damage from machinery resulting in bare peat, hard and slippy ground, short *Calluna*, algal hollows, a lot of surface water and a dominance by *R. alba, Trichophorum* or *Narthecium*. There is a small area of Complex 4/2 to the SW of the site and it is associated with old drains and an area of active peat cutting close by. Machinery has possibly damaged the area.

Complex 6B (Burnt)
This is a recently burnt version of Complex 6. *Calluna* is very short (5-10cm) and *Carex panicea* (10%) and *Trichophorum* (10%) are more abundant. The surface is very hard and more uniform. It is seen in and around Flush Z. Where it occurs within the flush patches of *Molinia* are seen in it.

Complex 6/3
Narthecium and *Carex panicea* dominate this complex which is seen at the centre of the E side of Flush Y. The *Sphagnum* cover is low.

Complex 6/3 B+ *Myrica* (My)
This complex is seen between the lines of *Molinia* in the flush. *Narthecium* and *Carex panicea* dominate with short *Calluna* (10cm). The *Sphagnum* cover is moderate but the surface is mostly hard. Hummocks of *Leucobryum* occur which have been burnt (topped by *Cladonia floerkeana*). The *Myrica* is scattered throughout the complex with approximately 15% cover. This complex grades into Complex 6. Complex 6/3 B is very similar, just lacking the *Myrica*.

Complex 6/3/9
This is seen to the N of the site N of Drain Complex bD where there is Difco cutting carried out. It is dominated by *Narthecium, C. panicea* and *E. angustifolium*. There is a patch of *Phragmites* present and this is associated with Drain bD5 and a slope to the W from there.

6/3 + Tear Pools (TP)
Narthecium and *Carex panicea* dominated vegetation with tear pools is seen to the NE of the Main Lobe. These tear pools occur on the slope to the NE. Occasionally *S. cuspidatum* occurs in the tear pools. Another area of this complex can be seen in association with Slope 3 to the S of Drain Complex bD and yet another to the SW of the main bog in association with Drain bF. In the latter there is abundant *C. atrovirens* and *S. magellanicum* at the pool edges and deep erosion channels with *R. alba* in the pools in them.

Complex 6/3+ Algal Pools (AP)
This is seen to the NW of the site in an area where there is active peat cutting by both Difco and Hopper methods along two sides of the complex. It is dominated by *Narthecium* and *C. panicea* with some bare peat and unhealthy moderately sized pools. There is 5% *Cladonia* present.

Sub-Marginal Complexes
Complex 3+P+*Cl*
The southern edge of Complex 6/3+P+*Cl* grades into Complex 3+P+*Cl* for a very narrow band and then into Complex 3RB.

Complex 4/6/3+ Pools +*Cladonia* (P+Cl)
R. alba (20%) dominates in this complex which is seen to the E of the centre of the main lobe. *Narthecium* (10%), *Carex panicea* (10%) and *Trichophorum* are also common. *S. cuspidatum, R. alba, Menyanthes, Drosera anglica* and *S. auriculatum* occur in the pools (10%). The total *Sphagnum* cover is 25% with 10% *S. capillifolium* and 5% *S. papillosum* the remainder being the aquatic Sphagna. The bog surface is soft in places but is quite variable. *E. angustifolium* is scattered throughout and *Calluna* is also present in notable amounts (10-15cm tall).

Complex 4/6/3 +Tear Pools +*Cladonia* (TP+Cl)
This complex is seen along the SE edge S of the above complex. The pools have an E/W orientation and are mostly infilled with *R. alba* with some *S. papillosum* and *S. cuspidatum*. The *Sphagnum* cover is 20-25% mainly *S. capillifolium* and *S. papillosum*. There is still abundant *Calluna* (35% and up to 40cm tall).

Complex 6/7/9 +Tear Pools (TP)
This is seen to the S of Drain Complex bD and is associated with Slope 3 and the indications are that it has been burnt some time in the not too distant past. *Narthecium* cover is quite high but patchy and the *Calluna* cover is 35% and up to 25cm tall. *Eriophorum* species are abundant throughout. The *Sphagnum* cover is 15% and the ground soft. There is some *C. panicea* present. The pools are mostly healthy and support *S. cuspidatum, S. auriculatum, E. angustifolium* and *Menyanthes* though some are unhealthy and steep sided. They are aligned ENE/WSW.

Complex 6/7/9
A small area of this complex, similar to above but without the tear pools, is seen to the W of the site.

Complex 7/9A
This is closely associated with Complex 6/7/9 + TP and is on the N side of Drain Complex bD. It is dominated by *Calluna* and *E. angustifolium* with some *R. alba* - the latter probably as a result of machine damage which Difco cutting.

Complex 6 and 6+*Myrica* (My)
This is seen to the NW of the site and to the E of Flush Z. *Narthecium* dominates as in the complex below, however there is little or no *Cladonia portentosa* cover. The *Calluna* is about 30-40cm high but there are only a few tall hummocks and otherwise the micro-topography is very uniform. The *Sphagnum* cover is poor consisting mainly of *S. capillifolium* and *S. tenellum*. Some small, shallow *S. cuspidatum* pools with *Menyanthes* are seen in this complex, particularly in the more central areas. The bog surface is a little soft around these. Some patches of *E. angustifolium* are seen. To the W medium sized algal pools are quite common in this complex particularly where the bog surface flattens out. A *Rhododendron* bush (1.5m high) was seen in this complex close to the N side of Drain bH. To the E of Flush Z the *Narthecium* lawns/flats are quite large and are soft. One large patch of *Myrica* (1m tall) occurs with *Rubus, Pleurozium schreberi* and *Hylocomium splendens*. Just around the patch of *Myrica* there are some *S. cuspidatum* pools.

Complex 6 is also seen with the addition of *Myrica* at the E side of Flush Z.

Complex 6+*Cladonia* (+Cl)
This occurs at the NW edge in an area which has not been burnt for some time. *Narthecium* dominates (55%) with *Calluna* (20% and 30-40cm tall). *Cladonia portentosa* cover is approximately 25%. Some *Carex panicea, Trichophorum* (5%) and occasional *R. alba* hollows also occur. *Racomitrium* is seen frequently in small clumps. The total *Sphagnum* cover is 15%, consisting mostly of *S capillifolium* and *S. papillosum*. Some *S. capillifolium* hummocks are well developed. The surface is only a little soft close to the bog edge but further into the site it gets softer. *Pleurozia purpurea* and *Pedicularis sylvatica* were noted.

Complex 6+ Pools (+P)
This is seen to the SSE of the site close to the bog edge. It is dominated by *Narthecium*, pools and 35% *Calluna* which is up to 40cm tall. *R. alba* was seen in the inter-pool areas though these appear to be drying out. There is scattered *E. angustifolium* throughout. The pools are infilling with *S. cuspidatum, D. anglica, Menyanthes* and *E. angustifolium* with *S. papillosum* at the edges. Some of the pools inter-connect and one *Racomitrium* island was seen. *Cladonia* cover - not much - is highest on the islands. *S. fuscum, Pedicularis sylvatica* and large *S. capillifolium* hummocks were seen. The terrain of the complex is not soft except nearer the pools.

Complex 6+Pools+*Myrica* (P+My)
This is seen covering a small area close to the N side of Drain bH to the W of the bog. *S. cuspidatum* pools with *Menyanthes* cover about 15% of the complex. The pools are up to 10m by 5m with *E. angustifolium* all around them and are infilling with *S. cuspidatum, S. auriculatum, E. angustifolium. Menyanthes* and *Drosera* with *S. magellanicum* around the edges. *S. fuscum* was noted in this area. The bog surface is quite soft. It may be associated with localised subsidence due to the effect of Drain bH.

Another area of this complex can be seen along the mid-southern edge and the subsidence along the slope is associated with old peat cutting.

Sub-Central Complexes
Complex 6/9A B (Burnt)
This is seen in two small areas to the S and SE of Flush Z. *Narthecium* and *E. angustifolium* dominate. The *Sphagnum* cover is approximately 30% and the surface is a little soft. *Menyanthes* is scattered through the complex. *Calluna* is very short.

Complex 9A/6/4+ Pools (P)
This is a wet area seen to the E of the Main Lobe. *E angustifolium* dominates (fruiting well) with abundant *Narthecium, E. vaginatum* and low *Calluna*. The *Sphagnum* cover varies between 35-40%, mostly *S. papillosum* and *S. capillifolium*. *R. alba* is frequent in places and small algal hollows also occur close to the road. Further into the bog the pools become larger (sometimes interconnecting) and more frequent (25%). Most had a low water table at the time of the survey. *S. cuspidatum* appears to be being replaced by *Narthecium* and *S. papillosum* but some are bare or algal. These pools appear to be being affected by drainage. Burning has occurred in this area in the past. The inter-pool areas are only a little soft underfoot but the infilled pools are very wet and soft. *Aulacomnium palustre, Pleurozia purpurea* and *S. fuscum* were noted in this complex.

Complex 6/3 + *Cladonia* (Cl)
This complex is seen to the W of the E lobe and there is 20% *Cladonia* present. The complex is dominated by *Narthecium* and *C. panicea* with *Calluna* 20% up to 50cm tall, *Sphagnum* < 15% though the surface is very soft and 20% *Trichophorum. Racomitrium, Pleurozia purpurea* and *Andromeda* were recorded. In places there is a high cover of *E. angustifolium* and *S. fuscum* (PM18:13).

Complex 6/3+ Pools +*Cladonia* (P+Cl)
This complex covers a large area to the S of the site. *Narthecium* (30%) dominates the inter-pool areas with mostly scattered *Carex panicea* (15%) but sometimes forming patches. *Trichophorum* (10%) and *R. alba* (5%) are also present. *Calluna* is tall (30cm) and *Cladonia portentosa* cover varies from 5-10% suggesting that there has been no recent burning. The pools (20%) are more or less aligned SW/NE but various orientations are seen. Although the pools are linear they are not very deep. However they are probably tears due to stress as on slope to cut-way. They are colonised by *S. cuspidatum, Menyanthes* and *Drosera anglica* with *Campylopus atrovirens* seen at the edges. *Carex limosa, Cladipodiella fluitans* and *S. auriculatum* were also seen. Some pools are bare or algal. *Sphagnum* cover is low on the inter-pool sections but some hummocks of *S. imbricatum* were noted. *Racomitrium* was also recorded.

6.2.2 Flushes
Flush Z is large *Molinia* dominated area with the *Molinia* occurring in wide bands which are aligned more or less N/S. It covers approximately 15ha of the site with enriched ombrotrophic vegetation between the bands. The flush is associated with Slopes 2 and 3. Much of the flush has recently been burnt. To the W the *Calluna* is about 5-10cm high and there in a lot of *Narthecium* and some *Carex panicea* with the *Molinia. Potentilla erecta* is also seen. The *Sphagnum* layer is about 20%, mainly *S. capillifolium* and *S. tenellum* with some *S. imbricatum*. In the main body of the flush *Molinia* and *Myrica* dominate with *Calluna, E. tetralix* and *Narthecium*. Notable amounts of *S. imbricatum* are seen. Other species noted were *Succisa, Potentilla erecta* and *Pedicularis sylvatica*. On hummocks *Vaccinium myrtillus* and *Aulacomnium* occur. On the crest of the slope *Phragmites* occurs. Some trees are also seen, both *Salix* and *Betula*. One *Salix* (2.5m tall) is surrounded by

smaller *Salix* trees, some *Betula* and *Juncus effusus*. The trees have been burnt as burnt stems are obvious. One *Betula* is surrounded by *Menyanthes*. *Polygala vulgaris* and *Pedicularis sylvatica* are common with *Vaccinium oxycoccus* overgrowing *Leucobryum* hummocks. *Sphagnum* cover is high throughout this section of the flush, mostly *S. capillifolium* and *S. papillosum* but also large amounts of *S. imbricatum* (degraded in places but regenerating). *Aulacomnium palustre* is also common.

The centre of the northern side of the flush now consists of new drains bB2 and bD which flow from one swallow-hole to the other but do not link. Prior to this there was a channel running E/W which was sometimes sub-terranean. Along this channel/drain *V. myrtillus, Myrica, Molinia, Osmunda, Juncus effusus* and *Dryopteris dilatata* are growing and one small clump of *Salix*. There is considerable flow from the west end of the channel east towards the *Salix* clump where the water disappears. There is also flow west of this clump to the W and to the E towards a deepened swallow-hole and Drain b3B which flows N off the bog. In the more westerly swallow-hole *Osmunda, Agrostis, Carex paniculata* and *Glyceria fluitans* were recorded. At the deepened swallow-hole to the W of the flush *Rubus, Myrica, Agrostis, Succisa, Frangula alnus, Salix* and *Osmunda* were recorded. Drain bD is associated with Slope 3 and it stops abruptly at another swallow-hole which supports tall *Molinia* and *Calluna* with *J. effusus* and some *Phragmites*.
Flush Y is a linear flush, aligned N/S, seen to the NE of the site. It is associated with Slopes 4 and 5. It is separated into two sections by an area of more typical bog vegetation (Complex 6+P+My). The swallow holes are surrounded by *Molinia, Myrica, Pteridium* and *Calluna* with other species such as *Vaccinium myrtillus, Potentilla erecta, Blechnum spicant, Juncus effusus, Salix, Rubus, Dryopteris dilatata, Osmunda* and *Polytrichum alpestre* also occurring. *Phragmites* is seen on either side of the northern section of this flush. Some of the swallow holes are elongate forming channels. Running water was heard in some of the holes. *Molinia* dominates between the swallow holes.

7. BOG TYPE

This bog has been classified as a Ridge River C bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes

A number of slopes were estimated in the field. They are described below and are illustrated on the Slopes Map.

Slope 1 This is at the NW of the site and is the slope into a depressed area which supports a few large infilled pools. The slope from the SW is 0.3m over 30m.

Slope 2 This slope to the N from the S side of Flush Z is 4.5m over 300m to a depressed area.

Slope 3 This slope at the N of the site is from the summit of Drain bD (at a patch of *Phragmites*), and is 2m over 200m to the W as far as the swallow-hole on this drain.

Slope 4 This slope is at the N of the site and is 0.5m over 100m from the SSE towards Drain bD8.

Slope 5 This is the slope from the NE into Flush Y through an area of tear pools and is 0.5m over 50m.

Slope 6 This slope is at the very ENE of the site (E of track) and is associated with a patch of old peat cutting on the high bog which is perpendicular to the bog edge. The slope from the N is 1m over 50m.

Slope 7 This slope is at the E of the site (E of track) and is 0.5m over 30m W towards the track.

Slope 8 This long slope from the centre of the site (S end of Flush Z) eastwards is 6m over 1000m.

Slope 9 This slope from a linear patch of *Molinia* at the SSE of the site is 1m over 50m to an area of active peat cutting (hopper method) with 2m high facebanks. There is slumping in the area and *Myrica* throughout the vegetation on the slope.

Slope 10 This slope is close to Slope 9 at the SSE of the site and is associated with active peat cutting (hopper method). The facebanks are up to 3m tall and there is cracking and slumping at the bog edge. The slope is 0.75m over 30m.

Slope 11 This slope at the S of the site through Complex 6/3+Pools is approximately 2m over 100m.

Slope 12 This slope from the top of the high bog to the WNW of the site is approximately 3m over 600m.

8. RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

There is extensive peat cutting around this site except to the NE where the presence of Lough Gara has curtailed access. The peat cutting is both old and active and there are many drains - mostly old - around the bog associated with this. Some of these drains, especially in the separated NE lobe, are now non-functional. The older peat cutting - mostly by hand - has been carried out along the drains and not so much along the bog edge. More recent hand cut facebanks vary up to 1.5m and there is water ponding in stagnant pits, some flow to the bog edge along narrow channels, some peat regeneration and abundant *Calluna* on the old turf banks. The facebanks around the separated NE side of the bog are 2.5m deep at the W end reducing to 1-1.5m at the NE corner and reducing further along the eastern edge. Where the facebanks are shallow the bog grades into wet meadow and flood plain associated with Lough Gara.

At present there is also harvesting by Difco and Hopper. Difco is carried out along the N edge between Drain Complex bD; to the NW of the track; to the NE beyond the track; to the SE of the main bog; in the NW corner and at the W end of the N edge. The Hopper method of extraction is carried out to the NW beyond the track where the facebanks are up to 2.5m deep and to the mid S of the site (Slope 9) where they are up to 3m tall.

8.2.2 Fire History

Douglas and Mooney (1984) state in their report that most of the bog had been badly affected by fire in 1984 though a small area to the N had not been burnt since about 1978. One area to the NW (Complex 6+ Cl), possibly the same area mentioned by Douglas and Mooney (*op. cit.*), had not been burnt for some time. In fact the pattern of burning is obvious on the 1970s aerial photograph indicating that it may not have been burnt since at least the early 1970s. To the S of the bog Complex 6/3+P+Cl had not been burnt very recently either. The area in and around Flush Z has been burnt in the recent past. Most of the remainder of the site has suffered burning in the recent past with short *Calluna* and a fairly uniform topography typical.

8.2.3 Cattle Poaching

Cattle graze the flood plains and wet meadow between the bog and Lough Gara. The bog in this area is fenced off but there are some places where access to the bog is possible. At the S of the E Lobe next to the small river there is severe poaching of the bog surface. Parts of the ENE section of the bog are poached though not severely.

8.2.4 Dumping

There is some dumping of old cars at the S of the site along the bog road. There are also small amounts of household refuse dumped in places around the bog.

8.2.5 Agricultural Improvements

Cattle graze along the banks of the Lung River to the N of the site and also along the shores of Lough Gara. Drains have been inserted in places to facilitate this.

8.2.6 Forestry

There is a small coniferous plantation to the S of the bog N of the river. This was not present on the 1970s aerial photograph.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. A low relief mineral ridge runs under the site which is coincident with Flush Z. The peat layer is probably quite thin along the ridge.

2. Flush Y is an internal drainage system with swallow holes, typical of these more westerly sites.

3. Tear pools at the S of the site are associated with stresses caused by peat cutting and subsidence.

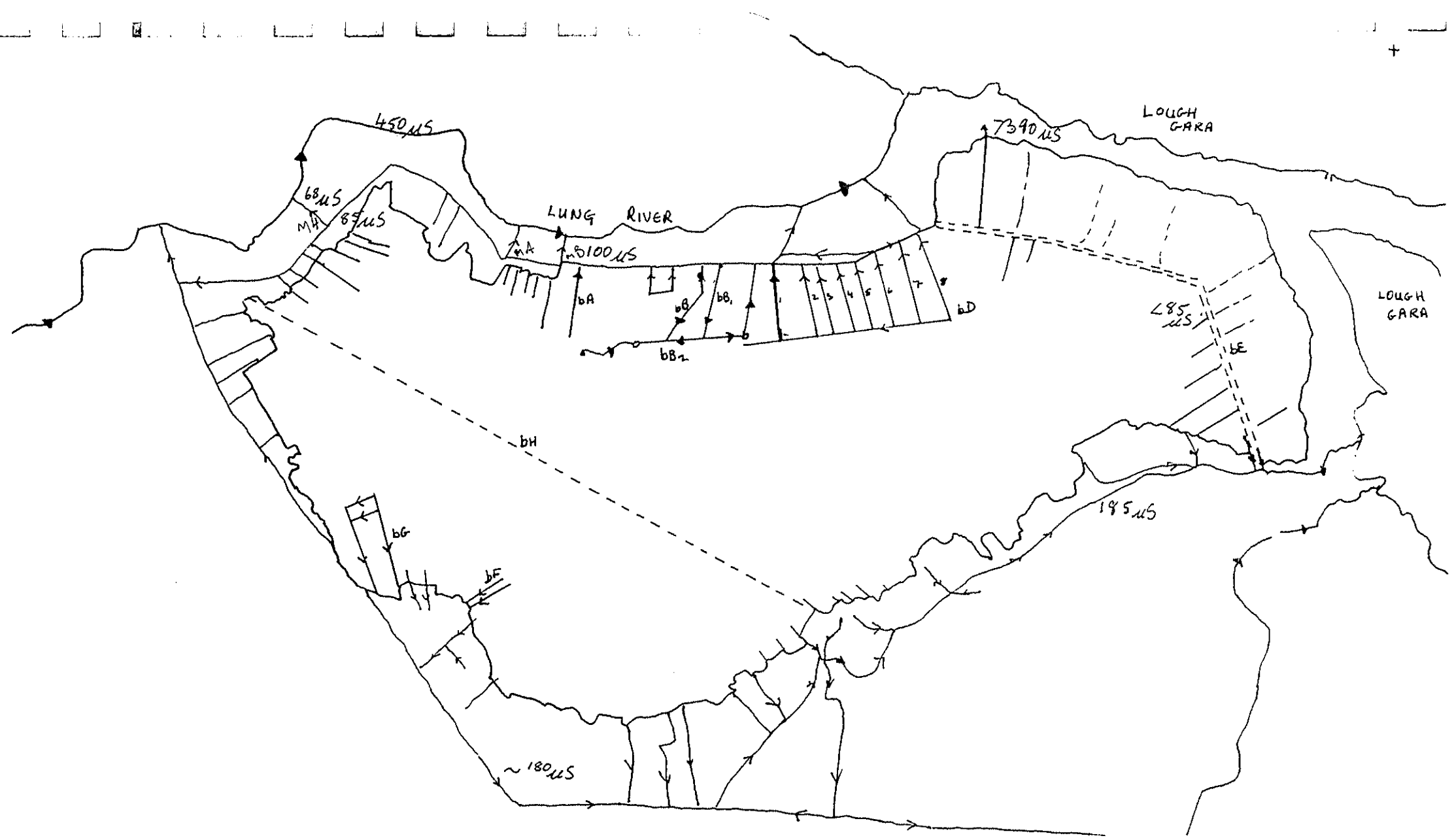
4. Roads and peat cutting on three sides of the site have caused considerable drying out.

5. The presence of *Myrica gale* on the slope to the N is probably associated with lateral water movement.

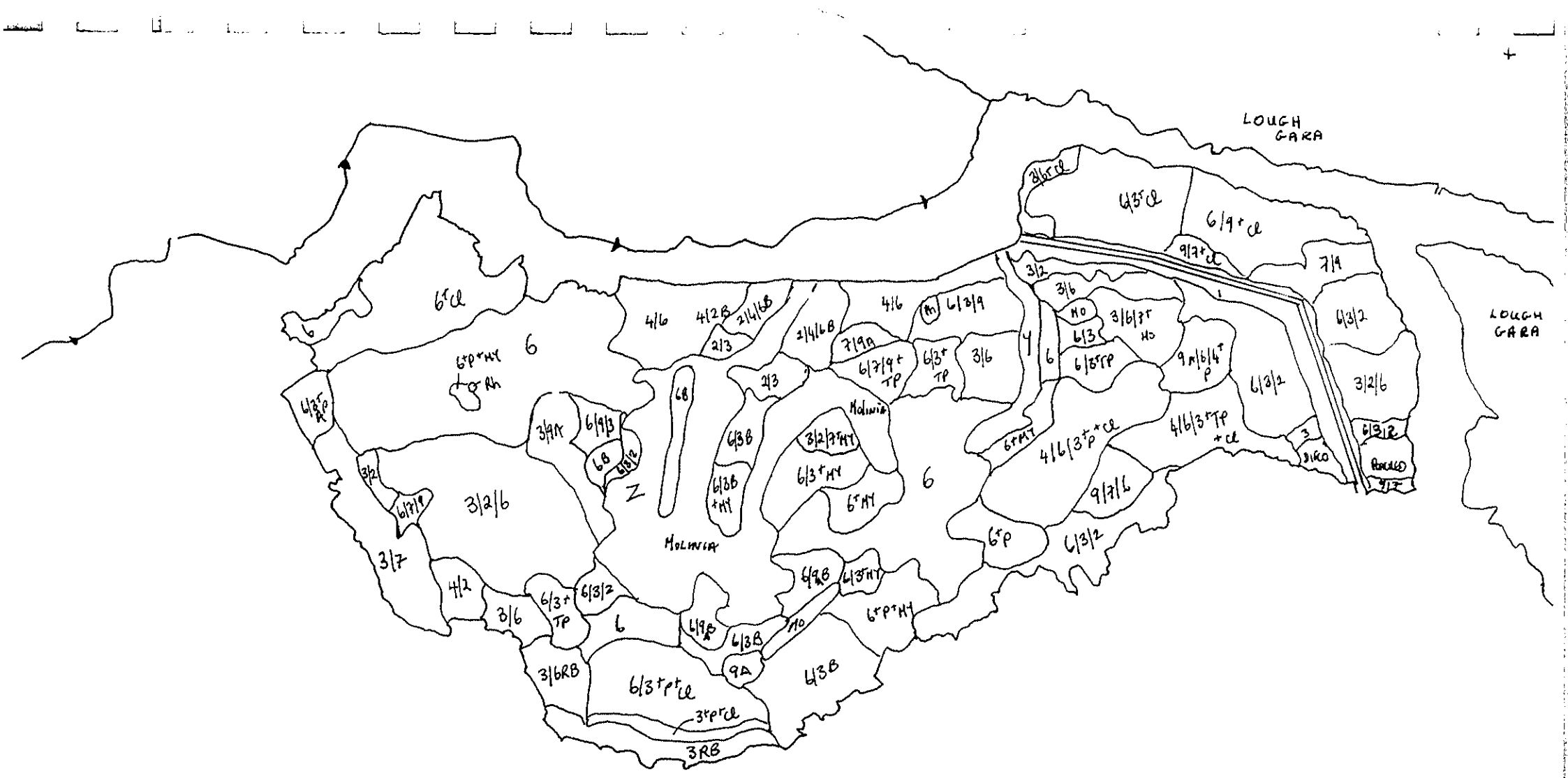
5. Burning has affected large sections of the site and there are few large *Sphagnum* hummocks.

Lara Kelly
Malcolm Doak
Marie Dromey

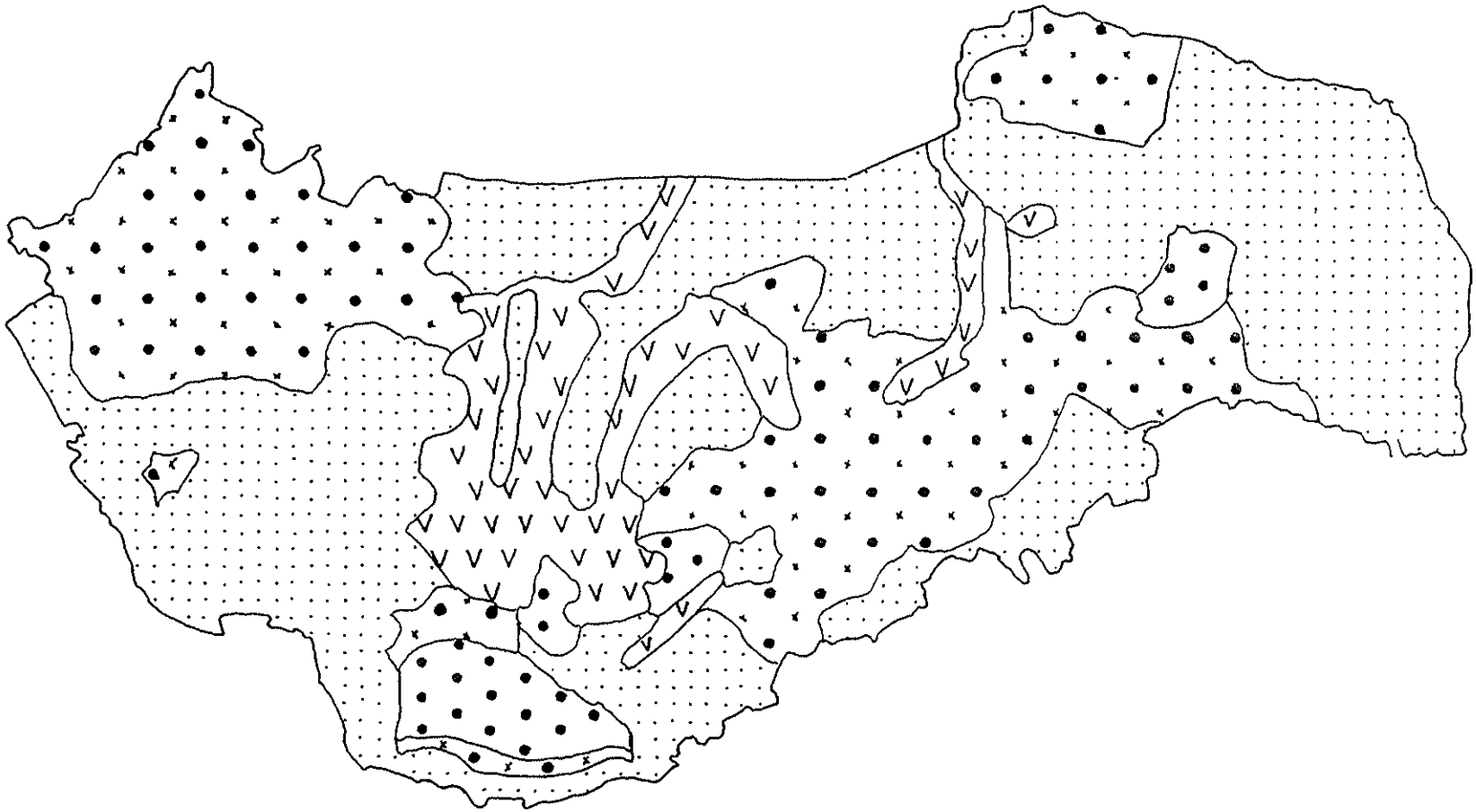
Raised Bog Restoration Project (1995).



CALLOW BOG, CO. ROSCOMMON (595).
DRAINS AND HYDROCHEMISTRY MAP (1:10.560)
1994

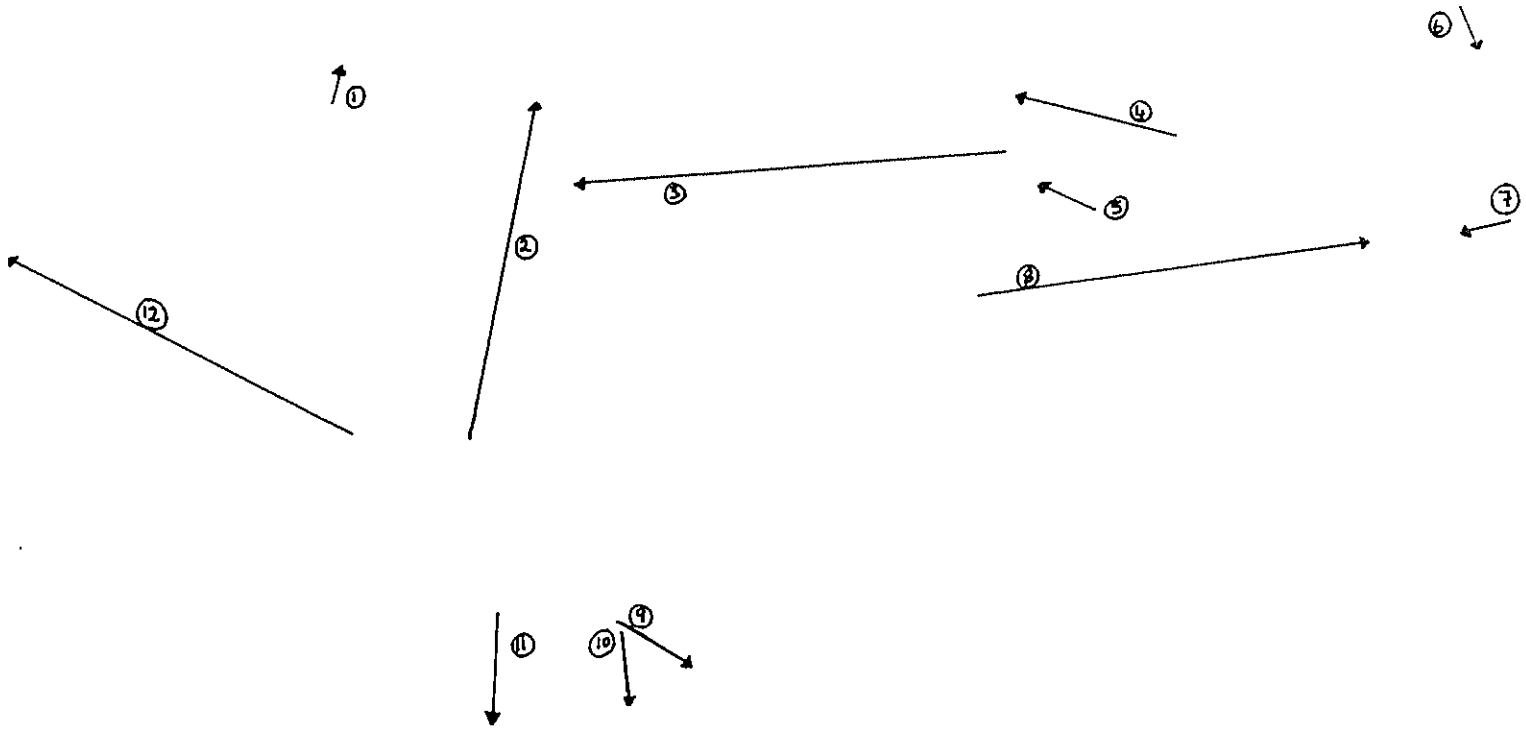


CALLOW BOG, CO. ROSCOMMON (595).
VEGETATION MAP (1:10,560)
1994



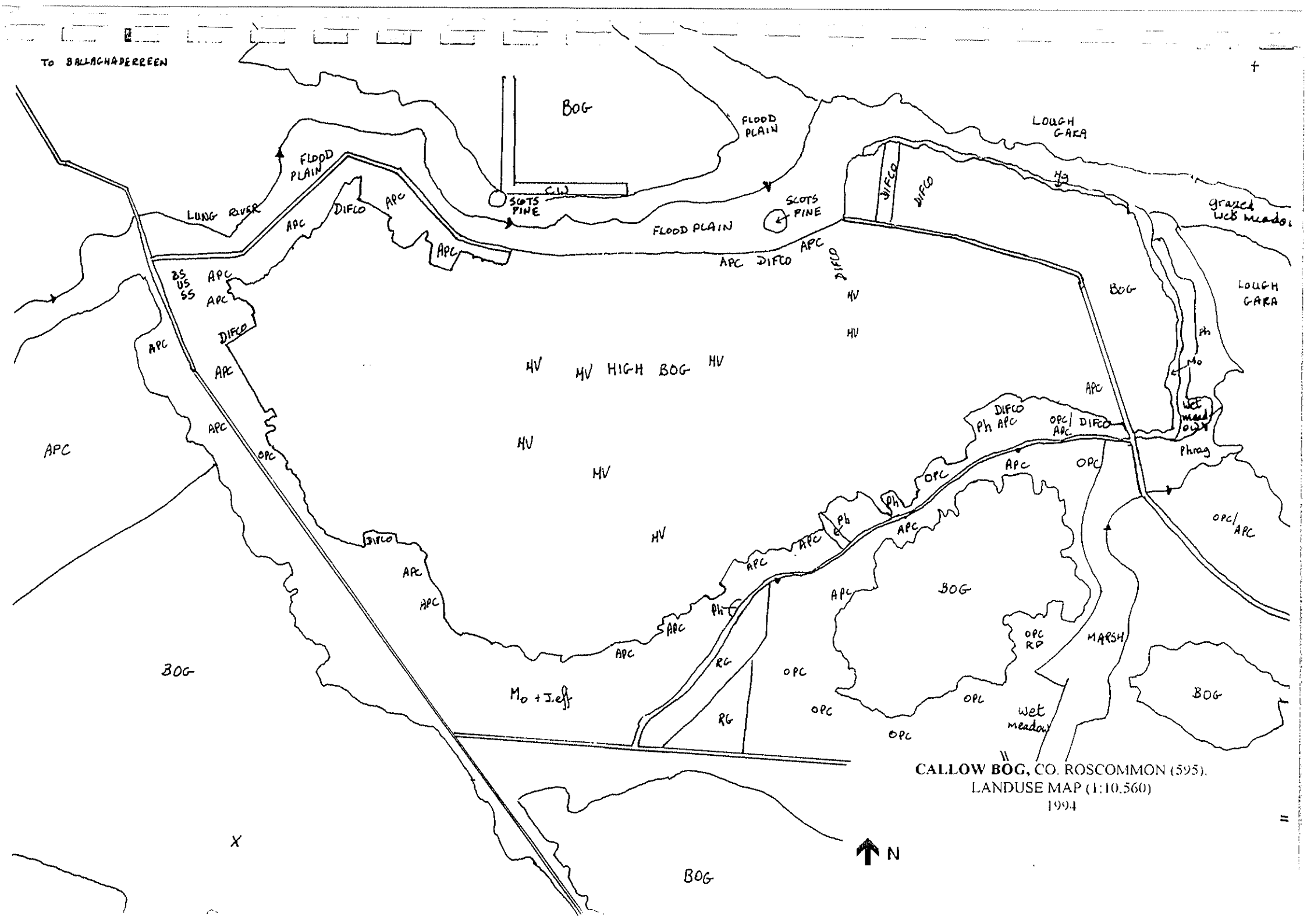
CALLOW BOG, CO. ROSCOMMON (595).
ECOTOPE MAP (1:10,560)
1994

N



CALLOW BOG, CO. ROSCOMMON (595).
SLOPES MAP (1:10,560)
1994

N



CALLOW BOG, CO. ROSCOMMON (595).
LANDUSE MAP (1:10.560)
1994

CARROWBEHY (CAHER) BOG, CO. ROSCOMMON

1. SUMMARY OF SITE DETAILS

NHA No.	597	1/2 Sheet:	11
Grid Ref:	M 57 83	6" Sheet:	RN 19
Other Photo:	OS (1993 B/W)	1:25000 Sheet:	14/27 NE
GSI Aerial Photo:	M 549	Area (ha):	189.5 (High Bog)
NHA Photo:	655:1-28 (1993 oblique)		
Date of Visit:	22 - 23/3/1994 (Ecology)		
	1-4 / 4/1994 & 14 /4/1994 (Geohydrology)		

Townlands: Taghnoosa, Taghnarra and Clooncan, Cloonalough, Caher and Lecarrow.

2. INTRODUCTION

2.1 BACKGROUND

Carrowbehy bog was visited by M. Schouten sometime during the period 1979 - 1981 (Douglas and Grogan, 1985). Field notes made by him, describe the site as being comparable to Mongan, with a well developed pattern of hummocks and steep sided pools (30% pools). He described the bog as being nearly undamaged but with some old drains on the eastern side. The vegetation in the drier, drained area consisted of *Carex paniceal Cladonia portentosa/Calluna* types. He also recorded areas that had been burnt which supported *Narthecium/ Erica tetralix/Carex panicea* types. He considered the site to be worth conserving.

The site was further visited as part of the National Raised Bog Survey (Douglas and Grogan, 1985). It was classified as an A site, being very wet and representative of western raised bogs. They also described extensive and well developed pool/hummock systems with hummocks of *Sphagnum imbricatum* and *S. fuscum*. They also noted an area of semi-natural lagg vegetation on the SE edge of the Northern Lobe, where three unusual or rare Sphagna were recorded.

Cross (1990) included this site in his list of raised bogs to form a conservation network since it is one of the largest remaining examples of a western raised bog and is an area of scientific interest (ASI). He noted the bog as very wet with a number of reasonably intact flushes, bog ponds, and well developed pools and hummock complexes. A section of this site which lies to the north grades naturally into a mesotrophic fen.

Because of these assessments purchase of the site was undertaken and the National Parks and Wildlife Service, Office of Public Works now own 184 ha out of a total of 276 ha.

Recent aerial photography shows that Carrowbehy bog has suffered little damage in the last 20 years apart from a small forestry plantation on the NW Lobe. The site was surveyed as part of this project where the present day vegetation cover and hydrological regime was assessed in order to ensure that conservation and restoration measures could be undertaken if required.

2.2 LOCATION AND ACCESS

Carrowbehy Bog is located in the western part of Co. Roscommon, 8km NE of Ballyhaunis and 9km N of Ballinlough. The site may be accessed along a bog road which runs along the northern edge of the NW Lobe and to the S of the Main Lobe in the region of Drain bM.

The site is traversed by a series of streams and drains which subdivide it into a number of lobes.

Main Lobe
This is a linear tract of bog running in a NNW - SSE direction. It is bounded to the west and north by streams, to the east by a number of hills and to the south by cut-away bog. The eastern part of

this lobe extends up over the side of one of the marginal hills. The main lobe is approximately 130ha in area.

NW Lobe
This lies to the north-west of the main lobe. The area is bounded by a stream on its northern and eastern sides, a hill to the south and by cut-away to the west. It is approximately 35ha in area.

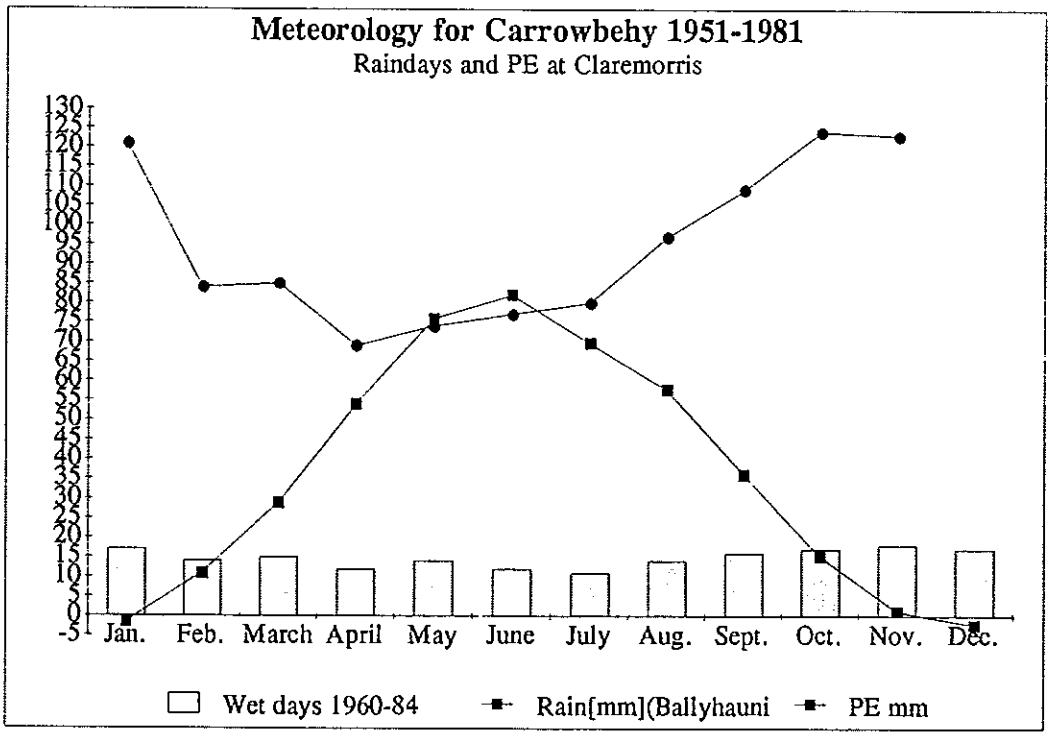
Northern Lobe
This lies to the north of the main lobe and is a remnant of a larger expanse of bog, part of which is now afforested. It is included here because of the poor fen which is developed on its SE corner. It is isolated from the other lobes by a large stream. This part of the bog has an area of approximately 25ha.

Western Lobe
This is the smallest of the lobes (approximately 20ha). It has been isolated from the main lobe by a series of large drains which form its eastern margin. The area is bounded by hills to the south and west and by a large stream to the north.

3. METEOROLOGY

No meteorological measurements have been made on Carrowbehy Bog. Rainfall data from nearby weather stations indicate that the area receives approximately 1174 mm of precipitation (P) per year. Fig. 9 shows the average monthly rainfall at Ballyhaunis rainfall station. The nearest synoptic station at Claremorris suggests that the site could have up to 177 wet days and up to 234 rain days annually.

Figure 9:



Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated

using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

PE is calculated to be approximately 450mm/yr for this area using contour maps. The above factors suggest that the year round actual evapotranspiration (AE) from Carrowbehy bog is greater than this PE figure. Annual evapotranspiration losses from the bog surface would therefore be greater than 450 mm/yr. Effective rainfall (ER) is the amount of rainfall available after evapotranspiration has been accounted for. ER is therefore 724 mm/yr.

Meteorological data for Carrowbehy bog (1951-1981) is summarised below:

Rainfall, P	1174 mm/yr
Actual Evapotranspiration, (AE)	>450 mm/yr
Potential recharge, (PR)	<724 mm/yr
Raindays > 0.2mm (annual {1951-80})	234 days

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

The bog has an irregular shape which is longest in the north - south orientation and narrowest in an east - west direction across the centre.

Peat bog dominates the topography of this area, where it occupies much of the low lying ground. The site is between 80 and 90 metres OD. Each of the lobes has a domed shape, that is, it has a steep gradient around its margins which becomes gentler moving towards the centre. The marginal gradient has been increased in areas affected by peat cutting and drainage.

Raised bog hummock and hollow microtopography is present and these features are more elongated than on sites found further to the east.

The main lobe has two domes separated from one another by a prominent line of mounds and a lower lying flush. Apart from the Main Lobe, each of the lobes contains a single dome. The shape of the bog prior to human interference is not known.

Where significant slopes were seen in the field they were noted and mentioned in connection with their associated vegetation type in Section 8.2.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

A number of steep sided hills form the higher ground around the bog margins. They have a roughly elliptical shape and trend in a NW - SE direction. They have an average elevation of between 95 and 100m O.D. Aerial photographs suggest that these features are drumlins.

A prominent E-W trending esker ridge has been identified close to the northern margin of the Western Lobe. It has an average elevation of approximately 95m. Similar, smaller ridges are found close to the SE margin of the bog.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Little data is available concerning the bedrock geology of Carrowbehy Bog. Geological maps, produced by Wallace (1989) for the Boyle Catchment immediately to the north of the area, suggest that the site is underlain by the Lower Carboniferous Ballymore Limestone. This unit is a relatively clean limestone at its base which becomes more shaley further up the geological succession. Consequently, the base of the unit is likely to be relatively permeable but permeability decreases as shale content increases.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

No subsoils data were found for Carrowbehy Bog apart from those contained in geological maps from the 1840s. No subdivision of units was made on these maps apart from the distinction between bog and inorganic deposits.

Recent detailed maps have been produced by Doak (1994) for the areas immediately to the south and west of the site. The maps subdivide subsoils into a number of lithologically distinct units.

Geology of Inorganic Subsoils

The subsoil geology of Carrowbehy Bog and the surrounding area is dominated by glacial till and fluvioglacial deposits. Poorly sorted tills are believed to form the drumlins which occupy the higher ground surrounding the bog. Till is also found in lower lying areas underlying the bog.

The composition of the till suggests that the subsoil should have a moderate to high permeability causing it to be relatively free draining. However, a hard, low permeability iron pan has been noted in many sections in the cut-away drains. The pan is at or close to the interface between the inorganic subsoil and the overlying peat. It is up to 50cm thick and is believed to form an effective barrier to downward percolating water. This horizon would have encouraged waterlogging in the past, thus allowing conditions suitable for peat formation to develop.

Iron pans have not been noted in free draining areas but are believed to have developed below the peat covered drumlin to the west of the main lobe. This would have allowed bog to grow on an otherwise permeable substrate.

Esker deposits are also found in the area. They consist of cross bedded sands and gravels derived from sandstone and limestone parent material and are found in the east-west trending ridge which runs parallel to the northern margin of the western lobe. No iron pan has been noted in these deposits. The first topographic maps of this area, produced in 1838, show the area currently occupied by the esker to have been covered in bog. It is likely that the line of mounds which run across the central part of the Main Lobe are underlain by esker sands and gravels.

Peat

Peat is the youngest and commonest subsoil type in the area. Geological maps produced in the 1840s show that it once covered all but the highest ground. Thin layers of peat have been noted on a drumlin on the eastern margin of the main lobe although thicker and more extensive deposits are found in the lower bog areas between the mounds of inorganic material.

Catotelm is exposed at the ground surface in areas where the acrotelm is absent. Exposed catotelm is generally compact and dense as a result of subsidence and drainage. Compact catotelm is usually found around the margins of bog and in areas affected by high bog drainage. A line of mounds which cross the central part of the Main Lobe are made up of compact peat.

More than 2 metres of compacted peat have been observed in drains and face banks around the bog margins. Thicknesses in the centre of the area remain unknown.

5.1.3 Depth to Bedrock

There was no depth to bedrock information available for Carrowbehy Bog or its surroundings in the GSI archives. No outcrop has been noted in the area.

5.2 HYDROLOGY

Both the bog and its surroundings lie within the upper reaches of the Suck. The catchment divide between the Suck and Boyle Rivers forms the northern boundary of the site.

5.2.1 High Bog Hydrology (See Drains and Hydrochemistry Map)

The hydrological regime of Carrowbehy Bog is believed to differ from sites found further to the east. A brief investigation of the high bog revealed a number of drainage features, some of which have not been noted on more easterly sites. The most important of these are:

(a) Longitudinal Pool Complexes: Interconnected elongated pools and intervening mounds have been noted over large areas of the uncut bog. They are best developed in those areas least affected by drainage. The complexes are associated with the areas of well developed acrotelm.

(b) Pipes / Swallow Holes: A number of elongated and funnel shaped enclosed hollows, some containing flowing water, have been noted on the Main Lobe. They are found in low points in the bog, in many cases in enclosed hollows. Reports in the literature refer to these features as macropores or pipes (Hobbs, 1989) and note that they are features more typical of blanket bog. Pipes act as zones of focused flow within the peat.

It is not known whether the holes developed on Carrowbehy Bog are natural features or whether they have been induced by drainage.

(c) Drains: A number of drains are found on the uncut bog. They are shown on the Drains and Hydrochemistry Map and are labelled with the suffix b to denote their position on the high bog.

North-Western Lobe

Drain bA: This has been inserted in connection with the *Pinus contorta* plantation on the western edge running N/S (PL4:5). It is 1.5m deep by 3-4m wide with 30cm of water (EC 78 µS/cm 23rd May 1994) flowing rapidly to the N and bare of vegetation. There are five other narrower and more shallow drains which are parallel to this and are also associated with the forestry. Old *Phragmites* stems may be seen in the bottom layers of peat exposed in the drains. There is much runoff from the high bog towards the drains which is causing serious peat erosion.

Drains bB and bC are short drains dug at right angles to Drain bA and are infilled with *Sphagnum cuspidatum* and *Eriophorum vaginatum*.

Drain bD runs parallel to Drain bA at the southern side. It is infilled with *Sphagnum cuspidatum*, *Eriophorum vaginatum, Narthecium ossifragum* and *Rhynchospora alba*.

The drains on the northern side of this lobe are associated with active peat cutting. Most are bare of vegetation and there is rapid water flow to the north.

The river on the northern side of the lobe had an EC of 233 µS/cm at the time of the survey. There were occasional iron flushes along the banks of the river to the east of this lobe, EC 402 µS/cm.

Northern Lobe

Drain bK on the south west side is recent and bare of vegetation. It is associated with peat cutting.

Main Lobe

Drain bF on north-western side runs NE/SW and is infilled with *Rhynchospora alba*, *Eriophorum angustifolium*, algae and dead *Sphagnum cuspidatum*.

Drain bG. This long N/S drain at the E of the lobe is not natural and was installed sometime during the period between 1838 and 1912. The channel is between 0.5m and 1.5m wide and between 0.5m

and 2.5 m deep. The channel is peat lined and heavily overgrown along much of its course - much *Molinia* in the vicinity and an EC 80 µS/cm was recorded. Strong flow (approx. 0.4m deep) has been noted in the drain during periods of heavy rain. However, discharge is much weaker during drier periods (less than 0.2m of water). The wide variation in discharge is believed to reflect the influence of runoff from peat covered areas and a low baseflow component.

The ECs observed in Drain bG contrasts with those in Drains mA and mB. Flow in this drain is overwhelmingly dominated by low conductivity water. ECs greater than 100 µS/cm have not been recorded in this drain. This suggests that flow in this drain is dominated by bog water and that higher conductivity regional groundwater flowing from the adjacent drumlin discharges elsewhere.

Drain bH is an old drain at the northern tip of this lobe. It is infilled with *Eriophorum angustifolium, E. vaginatum, Calluna, Erica tetralix, Sphagnum papillosum, S. capillifolium* and *S. cuspidatum*.

Drain bM is a double drain on either side of the small bog road which was used to access the southern part of the site. The one on the northern side of the road has been deepened recently for all its length while the one to the south has only been deepened after the road ends. Alongside the road it is 4m wide but has become infilled with *Molinia, Eriophorum angustifolium, Sphagnum cuspidatum* and *Narthecium ossifragum*. At right angles to this road to the north there are a number of new deep drains.

Drain Complex bN on the south eastern side of the main lobe is a series of deep drains, the first of these is 1m deep by 4m wide. It is bare with approximately 30cm of water flowing to the NW. The second drain is similar but is colonised by *Molinia* and *Myrica*. The third and fourth drains are much smaller and are infilled with dead *Sphagnum cuspidatum*.

Drain bP is seen to the north of the western lobe of the main bog. It has a very rapid water flow towards the bog edge.

5.2.2 Bog Margin Hydrology

The hydrological regime of the bog margins is dominated by a number of large streams and drains, whose location and direction of flow are shown on the Drains and Hydrochemistry Map. The principal drains are discussed separately below.

Drain mA: This is the largest drain crossing the bog and forms the boundary between agricultural land on the north eastern margin of the main lobe and the uncut bog. The first Ordnance Survey maps, produced in 1838, show mA crossing the bog prior to drainage indicating it to be a natural stream. Drainage works have subsequently altered its channel and fixed its course. Measurements show this drain to be up to 1.5m deep and 2m wide. Strong flow (> 1.0m deep) has been observed in mA during wet and dry periods, reflecting a strong baseflow component in its discharge. The banks and bed of the channel are largely free of vegetation. The drain bed frequently cuts below the level of the iron pan substrate along much of its course.

Drain mB. This drain is a natural stream which flows across the northern part of the bog. It is smaller in size than mA, being approximately 1.5m wide and 1.5m to 2.0m deep. Strong flow (> 0.75m deep) has been observed during both wet and dry periods. The channel is largely free of vegetation. The drain cuts below the iron pan intermittently. Drains mA and mB coalesce to form mAB along the northern boundary of the reserve. This stream/river had an EC of 233 µS/cm at the time of the survey. The EC was higher (402 µS/cm on 23rd May, 1994) in areas where there were iron flushes along the banks.

Drain mC. This is an extension of Drain bG and flows into Drain mAB to form Drain mABC. The combined Catchment of these three drains (including Drain bG) covers more than half the reserve area. It is roughly outlined in Figure 3.

Drain mD. Drain mD is a small drain which flows along the southern margin of the bog. It is rarely more than 50cm wide x 50cm deep. The channel is peat lined and much of it is heavily vegetated. Low to moderate flow (0.3m deep) was observed during a period of heavy rain.

Drain mE: This is an artificial peat lined marginal drain which is between 0.5m and 0.75m wide and up to 2m deep. although less than 20cm of water was noted in it at the time of examination. Flow was visible over most of its course during wet conditions. The channel is heavily vegetated.

Drain mF: This is a newly deepened peat lined channel with a bed of gravely till over most of its course. It is between 1 to 1.5m wide and up to 2m deep. It is not a natural drainage feature. Less than 50cm of water was observed flowing in it during wet conditions although flow direction was visible.

Drain mG: This drain is a small drain which flows along the south western margin of the bog. It is rarely more than 50cm wide x 50cm deep. It is not a natural drainage feature. The channel is peat lined and much of it is heavily vegetated. Low to moderate flow (0.3m deep) was observed during period of heavy rain.

Drain mH is a deep old drain (3m deep and wide) at the edge of the high bog on the southern side of the NW lobe. It is infilled with *Molinia, Juncus effusus, Cardamine pratensis, Mentha aquatica* and *Galium palustre* (PL4:9 toward west) EC 110 µS/cm. Erosion channels are also running into this drain carrying water from the high bog.

Drain mJ on the north-western facebank of the Northern Lobe, approximately 0.75m deep by 2m wide, infilled with *Eriophorum angustifolium*, *Calluna* and *Sphagnum cuspidatum*.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map)

All marginal drains were surveyed between 1/4/1994 and the 4/4/1994 at the end of a prolonged wet period. (The area had experienced heavy rainfall during the survey period and for the three days prior to it.) Drains along the northern margin of the north-western lobe were briefly re-examined on the 14/4/1994 during drier conditions. (No rainfall had occurred over the previous three days).

EC was measured in drains flowing both from the bog and the adjacent inorganic subsoil. A strong contrast between the waters flowing from the two areas was noted. Water flowing from the bog has low EC, typically less than 100 µS/cm. These values are similar to those of rainfall reflecting the inert nature of the peat. In comparison, the EC of the regional groundwater flowing through the inorganic subsoils is greater, typically over 200 µS/cm. However, the EC of regional groundwater is lower than that observed around similar bogs elsewhere. This may relate to the lower carbonate content of the till and the high proportion of relatively inert silicate.

Eutrophication, a result of nutrient release due to mineralisation, has been noted close to many peat facebanks yet no measurable change in EC was observed.

5.3.2 Laboratory Hydrochemistry

A sample for analysis was collected by the ecological section from Flush Z to investigate if there was any ground water influence. There were no indications of upwelling ground as the sample had a typical ombrotrophic bog chemistry.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
The influence of bedrock on the hydrogeological regime of the area is not known but is suspected to be small.

The hydrology of the inorganic subsoils contrast strongly with that of peat covered areas. Most of these deposits are more free draining. Little of the water falling on these areas flows as runoff (10% approx.). Most of the effective rainfall on the inorganic subsoils enters the water table as recharge.

Bog Regime
The large drains that flow across the north-western part of the bog have high conductivities. This reflects a substantial groundwater contribution to their discharge. The ECs of drains mA and mB vary as they flow across the bog. An increase in the EC of the water in Drain/stream/river mA is notable along much of its course and this corresponds closely to those areas where the channel cuts below the base of the peat. The change in conductivity is believed to reflect regional groundwater discharging to the drain. Similar conditions are noted in Drain mB although a drop in EC is more notable. This is believed to reflect a greater relative contribution of bog water to discharge along much of the length of the drain.

Large variations in EC have been noted in Drain mB. ECs of between 100 and 150 µS/cm were recorded during the wet period between the 1st and 4th of April. This contrasts strongly with ECs of greater than 300 µS/cm which were measured during a later dry period. The variation is believed to reflect the strong influence of bog water on flow in the drain during wet periods and the stabilising contribution of regional groundwater to baseflow during drier intervals.

The southern marginal drains mD, mE and mG are dominated by low conductivity bog water. ECs rarely rise above 100 µS/cm reflecting the minor contribution made by regional groundwater to their overall discharge. Most of the groundwater flowing from the drumlins adjacent to these drains is believed to discharge to alternative areas.

The conductivity of the water in Drain mF is intermediate between that of bog water and regional groundwater reflecting contributions to flow from each of these sources.

In some peat covered areas of this bog the iron pan is suspected to be absent. Potential vertical discharge from the peat is greater in these areas. It is suspected that the line of mounds running across the central part of the Main Lobe are underlain by esker sands and gravels. These deposits have no Iron pan. Recharge is believed to have drained from the peat to the sands and gravels causing the permeability of the peat to decrease in response to compaction and drainage. Hence, the mounds composed of compact peat over sands and gravels now form a low permeability barrier which prevents much water from flowing from the southern area of acrotelm and pools on the main lobe to the lower lying flush immediately to the north.

It is notable that the many pipes are found on the sites of former ponds. It is suggested that the effects of subsidence caused by drainage increased the hydraulic gradient between the ponds and the bog margins beyond its critical level. The development of pipes would allow the water contained in ponds to be rapidly discharged, leaving the enclosed hollows observed on the bog .

However this idea does not explain pipe development in the central part of the main lobe. This area is a low point between the two peat domes in the area. It is unknown whether this area is a natural low point between the two areas or whether it has been produced as a result of subsidence due to drainage. It is thought likely that the line of pipes found in this area has developed along a natural line of weakness in the peat (J. Streefkerk, *pers. comm.*).

Interconnected elongated pools are features more typical of blanket bog areas which receive higher rainfall. It is suggested that these features have developed as a mechanism to cope with excessive rainfall by allowing it to be removed from the bog more easily.

Inter-relationship
The higher drumlin areas are the main zones of regional groundwater recharge. The potentiometric surface of groundwater is believed to mirror topography. The large drains around the bog margins which cut below iron pan and contain high EC waters are believed to intersect the groundwater table Such drains are thought to be the main zones of groundwater discharge.

6. VEGETATION

6.1 VEGETATION SUMMARY

This is a transitional or western raised bog, with many affinities to blanket bog. Thus it differs from the midland raised bogs by the almost complete absence of *Sphagnum magellanicum*, the more linear pool structure and the abundance of *Racomitrium lanuginosum*, *Pleurozia purpurea* and *Pedicularis sylvatica* in the inter-pool areas and *Sphagnum auriculatum* var. *auriculatum* in the pools. In addition *Andromeda polifolia* (Midland raised bog indicator) was only recorded close to a *Molinia* flush.

The vegetation of this site is characterised by interconnecting linear pools (tear pools) which are mainly algal or bare with some containing *Sphagnum cuspidatum*, *S. auriculatum* var. *auriculatum* and *Menyanthes trifoliata* and occasionally *Carex limosa*. The inter-pool areas tend to have a low to moderate *Sphagnum* cover and are dominated by *Calluna vulgaris*, *Erica tetralix*, *Eriophorum vaginatum*, *Carex panicea* and *Narthecium ossifragum* with a high occurrence of *Pleurozia purpurea* and *Pedicularis sylvatica*. Occasional hummocks of *Sphagnum imbricatum* and *S. fuscum* are seen but the main hummock forming bryophytes which occur are *Sphagnum capillifolium* and *Racomitrium lanuginosum*.

The cut-aways are mainly dominated by *Molinia* with frequent *Myrica gale* but to the south of the NW lobe there is a area of reclaimed land which is dominated by *Juncus effusus* and *Rhytidiadelphus squarrosa*. To the SW of this lobe there is some *Ulex* which is also seen along parts of the eastern edge of the main lobe and the north eastern edge of the northern lobe where some *Betula* and *Salix* sp. were also recorded.

Where the main lobe extends up over the drumlin to the east the vegetation is dominated by *Calluna vulgaris* and *Molinia caerulea* (PL4:16 towards east). On the top of this mound there is an area of heath vegetation dominated by *Calluna*, *Juncus effusus* and *J. squarrosus*. There are occasional small *Sphagnum cuspidatum* pools with *S. capillifolium* hummocks. Overall the surface is hard underfoot and the peat layer is very shallow. At the base of this drumlin *Molinia*, *Myrica* and *Schoenus nigricans* were seen.

Along the river floodplains the main species noted were *Carex elata*, *Juncus effusus*, *Festuca arundinacea*, *Filipendula ulmaria*, *Ranunculus repens*, *Rumex acetosella*, *Ranunculus ficaria*, *Angelica*, *Cirsium palustre*, *C. vulgare*, *Lythrum salicaria*, *Urtica dioica* and *Heracleum sphondylium* with *Molinia* and *Myrica gale* just beside the bog.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

The North Western Lobe

This area consists of approximately 50ha of domed high bog. The western and south-western edges of the site have a significant slope. At the SW edge the sloping area extends approximately 200m into the site whereas in the NW corner the slope is 2m over 400m into the cut-away. The vegetation cover consists of five complexes as follows.

Marginal Complexes

Complex 1

The facebank complex is seen along the northern edge associated with turf banks and on the southern side associated with Drain bE.

Complex 3/4

This complex is dominated by *Carex panicea* (40%) and *Rhynchospora alba* (30%) with some *Trichophorum cespitosum* (15%). It has not been burnt for some time as the lichen cover is high. The *Rhynchospora alba* is mostly confined to erosion channels (PL4:6). The area has some large bare erosion channels which extend approximately 30m onto the high bog. There is significant flow in the erosion channels and surface flow into Drain bA (PL4:7). *Pleurozia purpurea* (PL4:8) and *Campylopus atrovirens* are common in this area. *Huperzia selago* and *Pedicularis sylvatica* were also recorded. The main *Sphagnum* species seen is *S. capillifolium*. The bog surface tends to be hard within this complex.

Complex 3

This complex is dominated by *Carex panicea*. Tear pools are present which are mostly bare but some support *Sphagnum cuspidatum* and *S. auriculatum* growth. The pools are linear and smaller than in either Complex 14 or 35. Erosion channels occur on the north-western corner. There are some local areas with an acrotelm depth but overall there is little acrotelm development. *Rhynchospora fusca* was noted in some pools in this complex.

Central Complexes

Complex 14

This is a hummock/hollow area with frequent pools (35%). It occurs in a sunken area in the centre of the lobe slightly to the east. It is very quaking with an acrotelm. The pools have a more permanent appearance than in complexes 3 or 35 and contain *S. cuspidatum*, *S. auriculatum* and *Menyanthes trifoliata*, *Eriophorum angustifolium* and *Cladipodiella fluitans*. There is little *Calluna* and the *Sphagnum* cover is high, *S. capillifolium* (30%) and *S. papillosum* (10%), but there are few large hummocks.

Complex 35

This is a tear pool complex which forms most of the vegetation cover of the centre of this lobe. The pools are similar to those in complex 3, many filled with algae and with unhealthy *Sphagnum cuspidatum* and *S. auriculatum* growth. They are mainly aligned E/W but at the eastern side they are aligned N/S. There is a lot of *Campylopus atrovirens* at the pool edges. The main difference between this complex and complex 3 are that the pools are more extensive and interconnecting and the pools frequently contain *Racomitrium lanuginosum* island hummocks. *Sphagnum imbricatum* (5%) and *S. fuscum* hummocks also occur. Some pools have *Carex limosa*. Many of the pools are very deep and appear to be bottomless. In comparison to Complex 14, *Calluna* is more abundant and the inter-pool areas are not as quaking but harder underfoot with much *Pleurozia purpurea* and *Pedicularis sylvatica*. Towards the west of the complex *Sphagnum imbricatum* hummocks were more frequent. *Cladonia rangiferina* was re-recorded in this area during this survey. It was initially recorded by Douglas and Grogan (1985).

Northern Lobe
This is a small area of intact bog which has forestry on its northern section. No part of it is owned by the NPWS but it is of interest due to the poor fen in its SW corner. This was examined by Douglas and Grogan in 1985.

Marginal Complexes
Complex 3
This covers most of the intact bog in this area. It is similar to complex 3 above with mostly bare algal pools with unhealthy *Sphagnum cuspidatum* and *S. auriculatum* growth. *Rhynchospora fusca* was present in some pools. *Rhynchospora alba* was more abundant in the inter-pool areas than in complex 3 on the NW lobe. There were occasional *Racomitrium lanuginosum* and *S. imbricatum* hummocks.

Complex 3/2
Carex panicea and *Trichophorum cespitosum* are common with *Calluna* dominant (60%). There was no acrotelm layer.

The Main Lobe
This forms the largest high bog expanse of approximately 120 ha. It has two small lobes, one to the east and the other to the south west. The central area is dominated by a tear pool complex with *S. cuspidatum* and *S. auriculatum* in the pools. The inter-pool areas have a good *Sphagnum* cover. The vegetation cover of the marginal areas consists mainly of the *Carex panicea* dominated complex which also has a lot of tear pools but these tend to be more commonly algal.

Marginal Complexes
Complex 1
The facebank complex dominated by *Calluna* and *Hypnum jutlandicum* is seen in places all around the edges of this lobe. It is also seen on two mounds at the south western side of flush W. There is no acrotelm layer in this complex.

Complex 3/2
Areas along the north-western and northern edges dominated by *Carex panicea, Trichophorum cespitosum* and *Calluna* with a high lichen cover (60%). Algal pools are common and some pools contain *Sphagnum cuspidatum* and *S. auriculatum* growth. The northern area has more *Trichophorum cespitosum* and the slope of the bog to the river is steeper. The bog surface is hard.

Complex 3
This is found around the edges of the Main Lobe forming a wide band. It is similar to complex 3 described for the NW lobe. It is dominated by *Carex panicea* and linear algal tear pools. Some of these pools on the eastern edge are very deep and bare of vegetation. Occasionally *Juncus bulbosus* was recorded in these pools. To the northern section of this lobe the pools are less linear but still have the appearance of tear pools. *Huperzia selago* was noted.

In the SE corner of the site this complex (Complex 3 RB) had many indications of burning with areas of bare peat, poor *Sphagnum* cover and the occurrence of *Campylopus introflexus*.

On the east side of the Main Lobe, which slopes quite steeply east wards, this complex is dominant with a large number of tear pools aligned NE/SW.

At the SE side close to the double drain there are a number of erosion channels running through complex 3 carrying water into the drains.

Complex 3+ *Myrica* (My)
This is similar to complex 3 but with the addition of *Myrica gale* (10%). It is seen in the eastern central section between Lake Z and the eastern margin which extends up onto the drumlin flank. Its presence here with the addition of a number of very deep tear pools suggests some degree of water movement which may have caused slumping. The slope to the bog edge is gradual in this area but

there are a number of erosion channels. The bog surface is mostly hard. *Eleocharis multicaulis* was noted in a pool in this area.

Complex 3+ *Myrica* (My) (RB)
Seen in the south western lobe of the Main Lobe. The cover of *Campylopus introflexus* is greatly increased (55%). There is no *Sphagnum* cover and no pools.

Sub-Marginal Complexes
Complex 6
A small area dominated by *Narthecium ossifragum* (40%) in the south western lobe of the Main Lobe with *Sphagnum* cover (20%) and *Racomitrium lanuginosum*. The *Sphagnum* cover is mostly made up of *S. capillifolium* (15%) and *S. papillosum* (5%). There is some *Campylopus introflexus* which also suggests a burning history.

Complex 6+ *Myrica* (My)
An area east of Complex 6 and west of the drain complex N is dominated by *Narthecium* hollows/flats with the addition of *Myrica gale* and *Calluna* with *Eriophorum angustifolium* and *Carex panicea*. Within this complex there is an area which has been burnt in the recent past with a lot of *Campylopus introflexus* and very short *Calluna*.

Central Complex
Complex 35
This is the main complex of tear pools forming the vegetation of the flat central section of the Main Lobe. It is similar to that described for the NW lobe with the addition of some taller hummocks (1m tall by 2m wide) with *S. imbricatum* and *Dicranum scoparium*. The pools were similar with *S. cuspidatum*, *S. auriculatum*, *Menyanthes* and *Cladipodiella fluitans*. *Eleocharis multicaulis* and *Rhynchospora fusca* were also noted in some pools. A number of pools are bare or algal. Within the inter-connecting pools *Racomitrium* islands are frequent. The bog surface is soft but not very. The inter-pool areas have a good *Sphagnum* cover in places and *Rhynchospora alba* is quite common.

To the south of the site this complex has a higher frequency of pools but many are algal pools and the *Sphagnum* cover in the inter-pool areas is moderate with some low *Sphagnum imbricatum* hummocks. *Rhynchospora fusca* was recorded in some pools.
Where this complex approaches flush V it has a drier nature.

6.2.2 Flushes/Lakes

In the central section of the main lobe there are three infilling lakes which may be inter-connected. The northern most lake (Lake Y) has a large amount of open water. The edges are colonised by *Sphagnum cuspidatum, Carex rostrata, Juncus effusus, S. recurvum* var. *mucronatum, S. recurvum* var. *tenue, Menyanthes* and *Carex limosa* (EC 61 µS/cm). Close to the southern edge of this lake there are two infilled pools with *Eriophorum angustifolium*, *Sphagnum recurvum* and *Rhynchospora alba*. Further south again in a line between Lake Y and Lake Z there are a series of swallow holes, the most southerly one being located in a very sunken area with a fall of about 3 metres over about 30m on the northern and eastern sides with a more gentle slope to the west. *Myrica gale* was present in the vegetation on the approach to it from the south. This swallow hole had running water (EC 85µS/cm) as did the smaller two to the north. From the vegetation patterns in this area it would appear that there is a hydrological connection between the two lakes via the swallow holes. Lake Z is a larger feature than lake Y but supports a similar vegetation cover with *Carex rostrata*, *Juncus effusus*, *J. bulbosus* and *Sphagnum cuspidatum* in the open water area with lawns of *Sphagnum recurvum* var. *mucronatum* and *S. recurvum* var. *tenue* to the south (PL4:15 towards north). At the edges of the soak *Molinia*, *Calluna*, *Eriophorum vaginatum* and *Sphagnum capillifolium* are the dominant species with the following species also recorded: *Luzula multiflora*, *Agrostis canina*, *Dryopteris* sp., *Juncus squarrosus*, *Hylocomium splendens*, *Rhytidiadelphus squarrosus*, *Aulacomnium palustre*, *Pleurozium schreberi* and *Polytrichum commune* (EC 64 µS/cm). A water sample collected from Flush Z had a typical ombrotrophic chemistry indicating that there is no detectable ground water influence. Flush Y appears to be located in a slightly depressed area of the bog. Swallow holes were noted on the eastern side of this flush.

Soak X is a small feature to the south of the main lobe, colonised by *Juncus effusus*, *Aulacomnium palustre* and *Sphagnum recurvum* var. *mucronatum*. *Cephalozia connivens* and *Lophozia incisa* were also recorded here. *Pedicularis sylvatica* was frequent around the edge of this feature. Flush V is a small open water pool (EC 79 µS/cm) colonised by *Carex rostrata*, *Menyanthes trifoliata*, *Juncus effusus*. *Eriophorum angustifolium* and *S recurvum* var. *mucronatum* with tall *Calluna*, *Molinia*, *Vaccinium oxycoccus*, *Eriophorum vaginatum Pleurozium schreberi*, *Sphagnum capillifolium*, *Aulacomnium palustre*, *Hylocomium splendens* and *Hypnum jutlandicum* around the edges (P4:17).

Flush W is a large feature which runs across the central section of the site. It may lie over a mineral ridge as it appears to follow the path of an esker running E/W which may be seen on either side of the bog. It is dominated by *Molinia*, *Sphagnum capillifolium*, *Eriophorum angustifolium* with *Andromeda*, *Rubus* and *Blechnum* sp. recorded (This is the only place where *Andromeda* was recorded on this site). The flush is located in a sunken area, approximately 2m lower than the NNW side. The slope is more gentle to the east and south-east. On either side of the flush there are *Calluna* dominated mounds. There are a number of swallow holes in this flush where water could be seen underneath the bog surface. There was also evidence for water flow into some of this as the surrounding vegetation was flattened, erosion channels (containing *Rhynchospora alba* and *Eriophorum angustifolium*) were present and there were algal pools. It may be associated with drainage in the area or it may follow the course of an under ground stream. It is also possible that it may be hydrologically connected with the other soaks and flushes as the pattern mirrors that of the stream which runs to the west of the lobe. The EC of surface water running through the area was 77µS/cm.

Flush W grades into Flush T at its NE side. On the 1910 6" sheet a lake is marked in this area. Flush T is at the base of the drumlin and is associated with a drain. It is one of the wettest areas of the site with abundant *Sphagnum* growth, mainly extensive *S. cuspidatum* lawns and *S. papillosum* with some *S. magellanicum* and *Aulacomnium palustre*. *Vaccinium oxycoccus* and *Polytrichum alpestre* were also recorded. There is also a lot of *Rhynchospora alba* and some *R. fusca*.

7. BOG TYPE

This bog has been classified as a Basin bog type.

8. HUMAN IMPACT

8.1 RECENT HUMAN IMPACT (See Landuse Map)

8.1.1 Peat Cutting

This has been mainly confined to small localised areas due to inaccessibility caused by the rivers. The most extensive area of peat cutting has been on the southern side of the Main Lobe and the western side of the NW Lobe with smaller exploitation on the northern edge of the NW Lobe. On the northern side of the NW Lobe, associated with the peat cutting, there are some areas of abandoned difco cut peat. The eastern edge of the Main Lobe has also suffered some exploitation. At the SE side approximately 50m in from the face bank there is an area of old attempted cutting. This has become infilled with *S. cuspidatum*, *Rhynchospora fusca* and *Menyanthes*.

8.1.2 Fire History

The SW Lobe of the main lobe has suffered the most frequent burning with burning also evident on the NW Lobe and to the south of the Main Lobe, but there are indications that there has been a burning history over the whole site, with the frequent occurrence of species such as *Campylopus introflexus* and *Cladonia floerkeana*.

8.1.3 Forestry

On the eastern side of the NW Lobe next to the river there is a 3 year old *Pinus contorta* plantation. A large drain has been inserted in connection with this planting and erosion channels have developed

on the high bog leading into this drain. The drainage channels associated with planting have caused subsidence and compaction of the peat in the plantation sites and the areas immediately adjacent to them. Planting has also been carried out on the Northern Lobe.

8.1.4 Dumping

Dumping of household and farm refuse is carried out along the access road at the SE side of the site.

8.1.5 Agricultural Improvements

Pastural agriculture is practised in the well drained areas surrounding the bog. Some areas of cut-away bog and the more poorly drained parts of the surrounding drumlins are also farmed, although the intensity of land use in these areas is low. Much of the cut-over peatland has remained unused for a number of years and is now actively regenerating as scrubland.

8.1.6 Gravel Extraction

A number of small gravel pits have been excavated in the east-west trending esker ridge along the north side of the Western Lobe of the Main Lobe. None of these pits are operated continuously and are believed to have little to no influence on the hydrology of the bog.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. On the NW Lobe Complex 14, the wettest area with the most well developed pools, lies in a slightly depressed area. This appears to have originated due to subsidence. Water ponds in the sunken area and the water table level remains high for longer periods than in the surrounding area. This allows the *Sphagnum* layer to develop more than in the other complexes.

2. The flushes/lakes in the central section of the Main Lobe are also associated with depressed areas and may be hydrologically inter-connected. This is suggested by the presence of swallow holes.

3. Flush W, which runs E/W across the Main Lobe may be associated with a mineral ridge under the bog. Swallow holes are found within it and there is evidences of water flow. *Calluna* dominated mounds are seen on either side of this flush. Flush T, which is shown as a lake on the 1910 6" sheet, is situated at the northern end of this feature. It is possible that the depressed area, through which Flush W runs, may carry water from Flush T.

4. The occurrence of complex 3/4 on the NW Lobe is associated with erosion of the peat surface. This is related to increased surface water run-off caused by Drain bA, which is associated with the new forestry plantation.

5. Lateral water movement is indicated, by the presence of abundant *Myrica gale*, in two areas. One on the eastern side of the Main Lobe (Complex 3+) and the other on the western lobe of the Main Lobe (Complex 6+). Both of these Complex types are situated on gentle slopes.

6. The linear, steep sided nature of most of the pools on this site suggests that they may be tearing features due to subsidence at the bog edges causing stresses on the peat surface. The orientation of the pools, in general, corresponds to the long axes of the lobes, except at their shorter edges where the orientation is parallel to the edge and at right angles to the long axes. On the eastern side of the main lobe there are some very deep, long and narrow water filled cracks. These are certainly due to tearing of the bog surface as broken *Calluna* roots, which were once part of the same root, may now be seen on either side of the crack. These large cracks are located in the area where *Myrica gale* occurs and thus water nay be moving through this area to the bog edge. It is possible that slumping of the peat may have caused these cracks.

7. A section of the western lobe of the Main Lobe has been burnt very recently and is colonised by *Campylopus introflexus* and *Narthecium*. As the acrotelm has been mostly destroyed in this area there is a lot of surface water run-off.

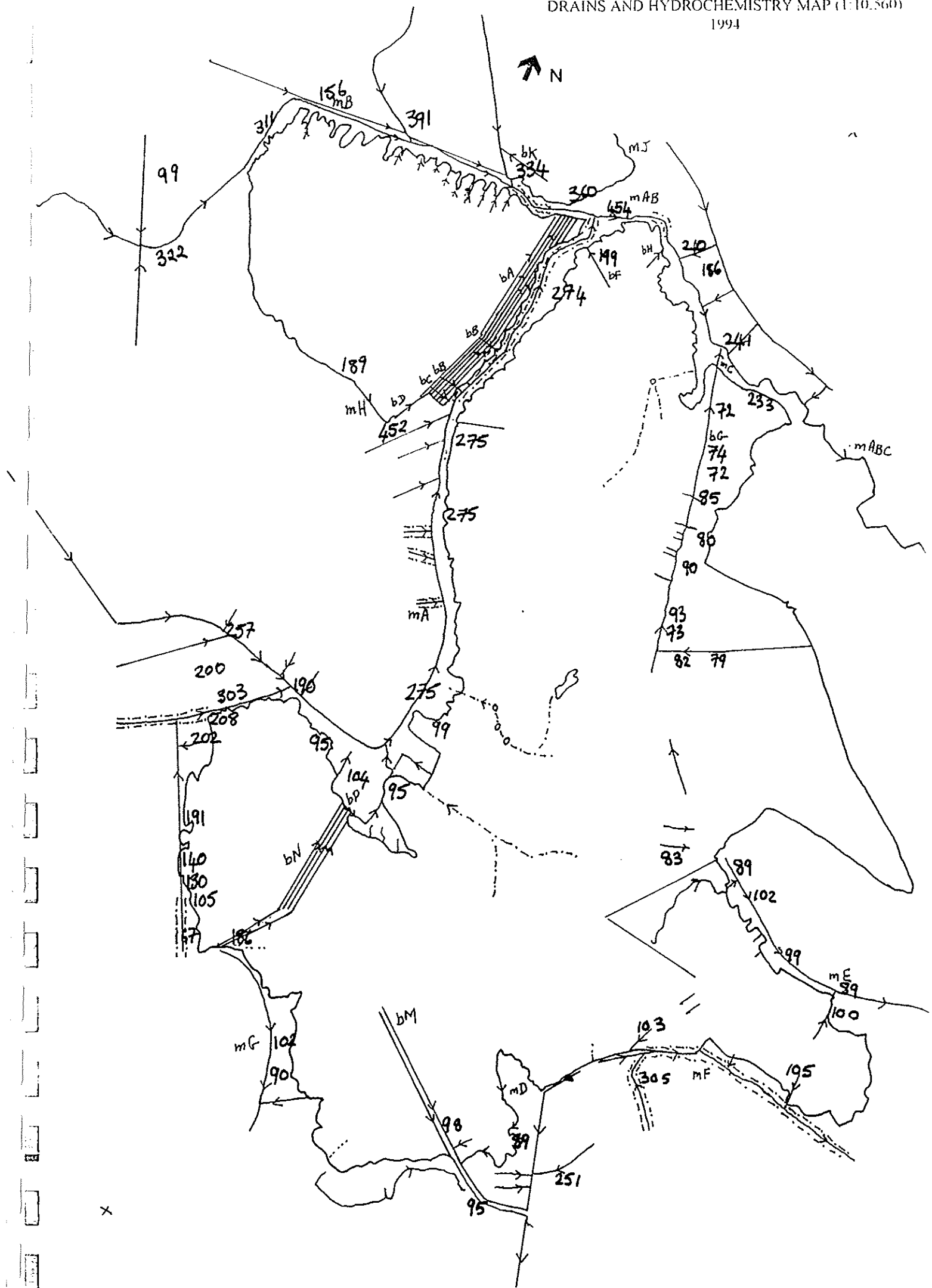
8. This is a western raised bog and therefore there is a greater maritime influence and the site experiences higher precipitation. This is reflected in the vegetation as it differs from the midland raised bogs by the almost complete absence of *Sphagnum magellanicum*, the abundance of *Racomitrium lanuginosum*, *Pleurozia purpurea* and *Pedicularis sylvatica* in the inter-pool areas and *Sphagnum auriculatum* var. *auriculatum* in the pools. In addition *Andromeda polifolia* (Midland raised bog indicator) was only recorded close to a *Molinia* flush.

9. A significant acrotelm layer is confined to the central vegetation complexes, namely 14 and 35. Complex 3 and its derivatives are generally associated with a poor or absent acrotelm layer. The acrotelm in the central Complex 35 is not as well developed as that which is seen in the central complexes of the midland raised bog sites. This is probably due to the lesser importance of *Sphagnum* species in the western sites with an increase in the cyperaceous species. There appears to be a relationship between slope and acrotelm at this site but it is not as clear as it is in the eastern sites.

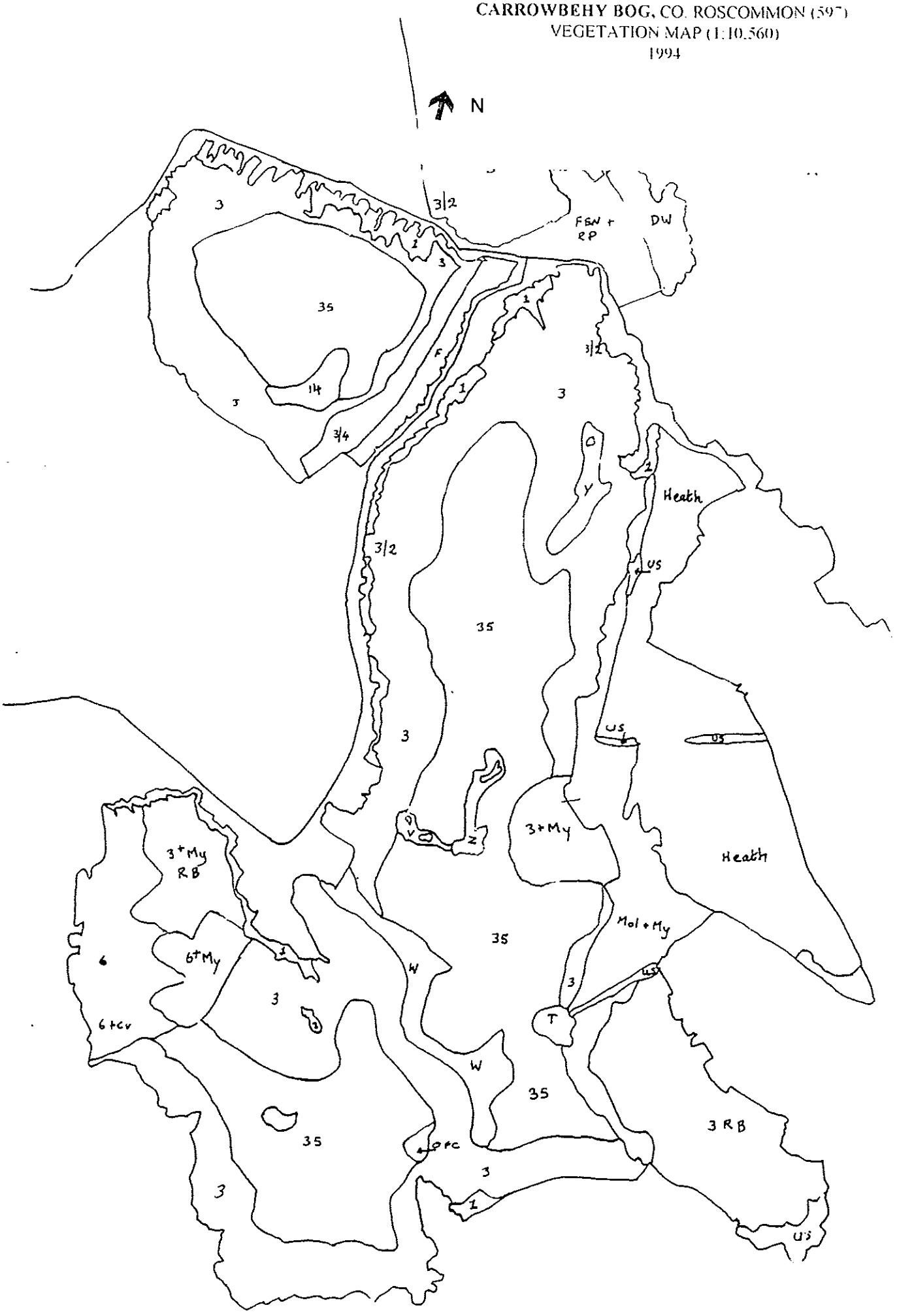
Lara Kelly,
Marie Dromey
Ray Flynn (modified by Malcolm Doak)

Raised Bog Restoration Project (1995).

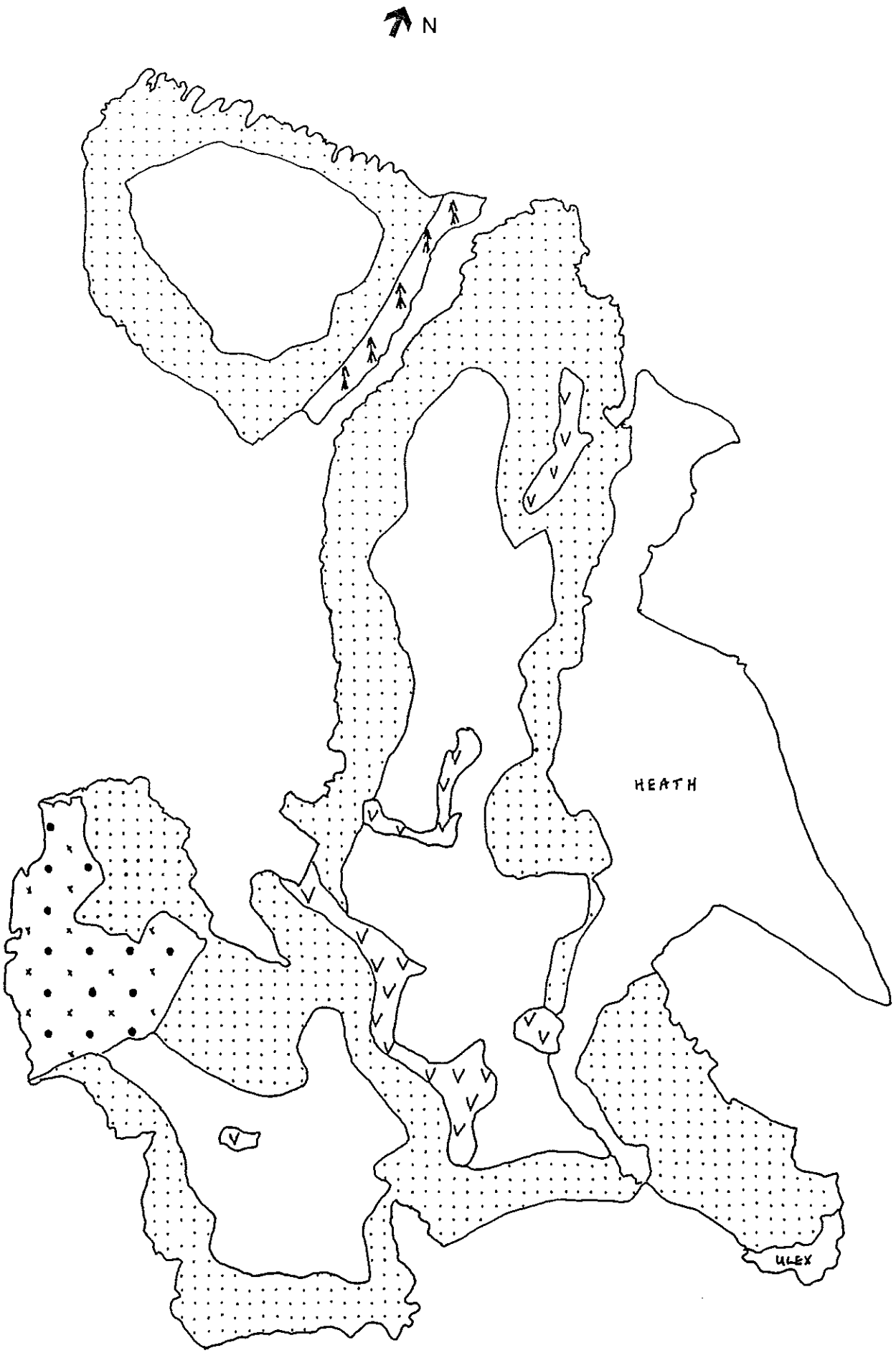
CARROWBEHY BOG, CO. ROSCOMMON (597).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994



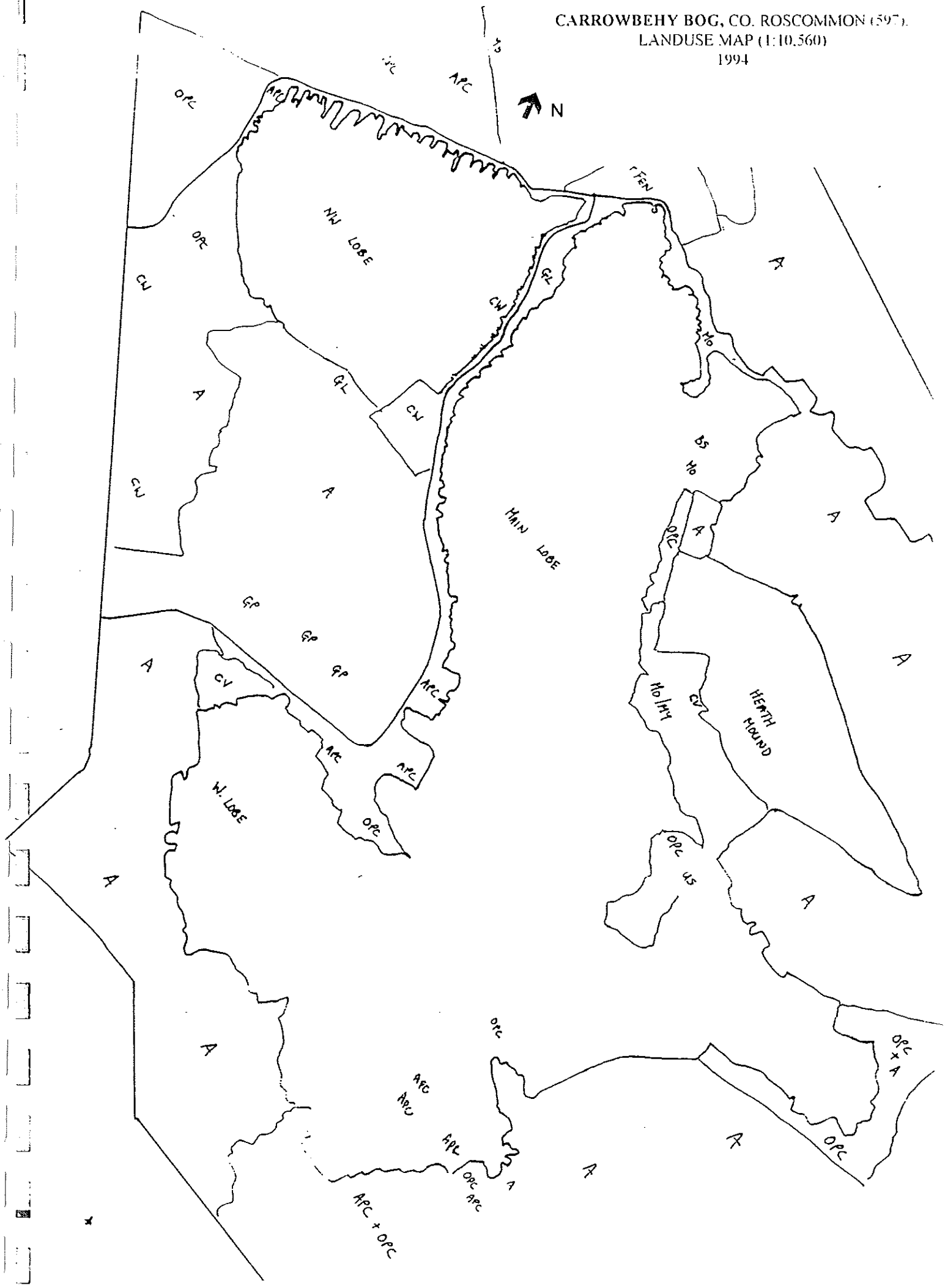
CARROWBEHY BOG, CO. ROSCOMMON (597)
VEGETATION MAP (1:10,560)
1994



CARROWBEHY BOG, CO. ROSCOMMON (597).
ECOTOPE MAP (1:10,560)
1994



CARROWBEHY BOG, CO. ROSCOMMON (597).
LANDUSE MAP (1:10,560)
1994



CLONFINANE, CO. TIPPERARY

1. SUMMARY OF SITE DETAILS

NHA No.	641	1/2" Sheet:	15
Grid Ref:	M 99 03	6" Sheet:	TY 5
GSI Aerial Photo:	M 447	1:25,000 Sheet:	17/19 NE
Other Photo:	SC 34058/59	Area (ha):	150.5 (High Bog)
Date(s) of Visit:	5-6/7/94 (Ecology) 5/7/94 (Geohydrology)		

Townlands: Clonfinane, Walshepark, Sharragh, Lisballyard and Rath.

2. INTRODUCTION

2.1 BACKGROUND

This site was visited by O'Connell and Mooney (1983) during the National Raised bog Survey. They describe it as a large flat bog with very wet areas of pools, hummocks and *Sphagnum* lawns. The NW section of the bog was much drier and had probably been burnt in the recent past. *Pinus sylvestris* trees were noted scattered over the site perhaps suggesting that the bog is drying out. A *Pinus sylvestris* woodland on the high bog was also described. *Pleurozia purpurea* was noted and they suggested that this may be an intermediate/western site.

The site was given A status and, along with Ballyduff bog which lies just to the E, was included in the list of possible raised bog NNRs (Cross, 1990).

A palynological, macrofossil and stratigraphical investigation was undertaken at this flush by O'Connell (1990). Some of her results are discussed in Section 6.2.2.

2.2 LOCATION AND ACCESS

This site is located approximately 6km to the west of Birr, Co. Offaly. The road from Birr to Portuma runs by the north of the site (T 41). Access to the bog may be gained from an old track which leads off the main road. Access from this is easiest via the small overgrown lane which leads to the drain which separates the NW Lobe from the SE Lobe.

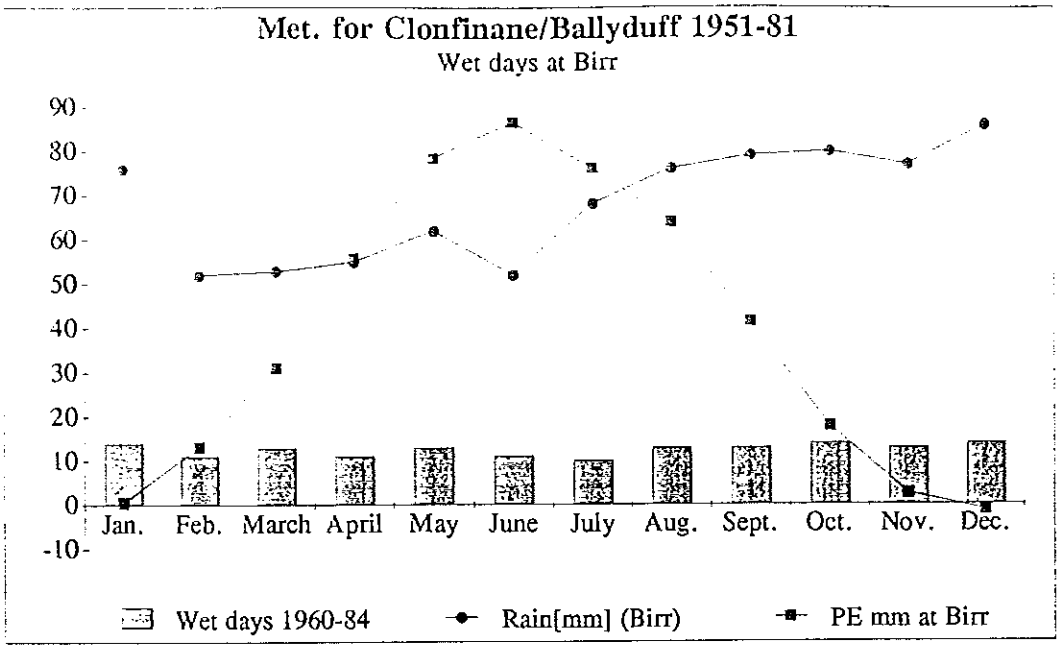
3. METEOROLOGY

No meteorological measurements have been made on Clonfinane bog. Rainfall data from the nearest rainfall station, the Birr synoptic station, for the years 1951-80 indicate that the area receives approximately 816mm of precipitation annually (Fig. 10).

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that the year round actual evapotranspiration (AE) from Clonfinane bog is greater than PE at Birr which had an average PE of 466.5mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Clonfinane would therefore be greater than 466.5mm/yr.

Figure 10:



The above factors suggest that the year round actual evapotranspiration (AE) from Ballyduff bog is greater than PE at Birr which had an average PE of 466.5mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Ballyduff would therefore be greater than 466.5mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 350mm/yr.

Meteorological data for Clonfinane Bog (1951-1981) are summarised below:

Rainfall (P)	816mm/yr
Actual Evapotranspiration, (AE)	>466.5mm/yr
Potential recharge, (PR)	<350mm/yr
Raindays > 0.2 mm (annual {1951-1980})	207 days

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

This is a relatively flat bog without a pronounced dome. A drain which separates a third of the bog to the N is located in a depression. At the edges of the site some slopes are seen into the cut-away.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

There is rising ground at the eastern side of the bog.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by Waulsortian Carboniferous limestones (fossiliferous mudmounds).
The Waulsortian limestones generally have a low permeability and are classed as a poor aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability
No subsoils data were available for Clonfinane bog apart from the 1840s GSI geology field sheets and recent fieldwork.

Geology of Inorganic Subsoils
Sections in drains in the cut-away areas to the NW indicate that the outer limits of the bog are underlain by poorly sorted stony till with relatively large sub-angular clasts composed of limestone . Laminated lake clays lie below the stony tills. Sands and gravels lie to the western margins of the bog.

5.1.3 Depth to Bedrock

Depth to rock on the bog is unknown.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology

Extensive drains are seen along the SW edge of the site in connection with the production of peat moss. An old double drain divides the bog and there are recent drainage works in the NE corner. The drains seen in the field are described below and their positions are shown on the Drains and Hydrochemistry Map.

Drain bA1 is the eastern drain of a double drain (shown on the 1910 6" sheet) which separates the bog into the northern third and the southern two thirds. It is 1.5m deep by 2m wide and contains 20cm of water (EC 94 µS/cm). It is infilled with *S. cuspidatum* and *S. auriculatum*. Drain bA2 is the western part of the double drain which is 1m wide and 0.75m deep with 60cm of standing water (EC 88 µS/cm). It is infilled with *S. cuspidatum, S. auriculatum, S. papillosum* and algae. Between the two drains *Calluna* (10-15cm) dominates with frequent *Eriophorum angustifolium. Campylopus introflexus* and bare peat are common (PL12:4 to SSW). Cattle have gained access here and the bog surface is poached.

Drain bB is an old, infilled non-functional drain which runs NNE/SSW in the northern third of the site. It is shown as a townland boundary on the 1910 6" sheet.

Drain bC runs at right angles to Drain bB. It is 0.5m wide and 15cm deep with 10cm of water. It appears to have been dammed in places. It is mostly bare with some algae and isolated patches of *S. cuspidatum* and *S. auriculatum*.

Drain bD runs NW/SE at the eastern corner of the northern section of the site. It is old and infilled with *S. cuspidatum, Drosera anglica, E. vaginatum* and *S. magellanicum* with *Calluna* and *E. vaginatum* along its edges. It is shown as a drain on the 1910 6" sheet.

Drain bE is part of an old double drain which is shown on the 1910 6" sheet and runs NW/SE at the northern side of the southern section of the bog. It is approximately 50cm deep and is infilled with *Phragmites, Molinia, Carex rostrata, Menyanthes* and *Rubus* (EC 220 µS/cm, Fe iridescence seen). Drain bE1 (EC also 220 µS/cm, Fe iridescence seen) to the N of bE is also infilled *with Carex rostrata* with *Betula, Pinus, Salix, Rubus* and *Lonicera* along its edges. Other species seen in this drain were *Carex diandra* The area between the two drains may have been a roadway. Species

recorded between the two drains included: *Calluna* (50cm high), *Pinus* (4m tall), *Betula* (1-2m), *Molinia, Dactylorhiza maculata, Pteridium, Rubus, Luzula, Quercus* and *Phragmites* (PM11:34 to S). To the east of Drain bG, Drain bE1 stops and is replaced by a *Calluna* dominated ridge. E of Drain bF, *Betula* and *Pteridium* dominate the track. To the E of bG, Drain bE becomes deeper (2 m) and supports *Juncus effusus, J. bulbosus, J. articulatus, Potamogeton polygonifolius, Osmunda, Rubus, Carex rostrata* and *Sagina procumbens* (EC 245 µS/cm).

Drain bF runs N/S from Drain bE to the bog edge. It is infilled with *Menyanthes, Juncus effusus, Carex rostrata, C. diandra, C. echinata, Cardamine pratensis, Anagallis tenellum, Calliergon cuspidatum* and *Pseudoscleropodium purpurum* (EC 138 µS/cm). Along its edges *Molinia, Potentilla erecta, Anthoxanthum, Rubus, Succisa pratensis* and mixed scrub grow.

Drain bG also runs N/S from Drain bE and is infilled with *Menyanthes, Molinia, Carex echinata, C. pulicharis, C. demissa, Aulacomnium palustre* and *S. capillifolium*.

Drain bH is a short drain seen at the SE end of Drain bE. It runs N/S to the NW of an area of *Betula* scrub. *Myrica* grows along the sides of this drain.

Drain bJ is part of the new development at the NE of the site. It runs NW/SE and at its N end it is 3m wide and 2m deep and is cut into the underlying till (EC 272 µS/cm) (PM11:37+PM12:1). *Phragmites* grows at the N end close to the bog edge (PL12: N end and PM12:1). It flows to the S as far as Drain bK. S of Drain bK it is only 1m deep by 0.5m wide with flow to the N into Drain bK (PL12:8 PM12:2). A line of spoil runs along the W side of the drain.

Drain bK runs perpendicular to Drain bJ and carries water eastwards into the cut-away.

Drain bM is 3m deep by 2m wide with a significant flow to the N and S. Till is exposed at its SE end and there is some Fe iridescence. At the SE end the remains of *Phragmites* and *Betula* may be seen in the peat profile. *Calluna* and *Phragmites* are seen growing on the edges of the drain at this end.

Drain Complex bN forms the network of drains associated with the moss peat production along the SW edge of the site. bN1 is a double drain which runs NW/SE along the SE part of the southern section of the site (PL12:16 to SE). It runs along a townland boundary marked on the 1910 6" sheet. They are 1m deep by 0.25m wide and contain 75cm of water. They are bare and collapsed in places. A series of drains run at right angles to these leading to the bog edge and they extend approximately 2m further into the bog past the double drain. (Pl2:10 to SW and PL12:17). In the central section *Narthecium* and bare peat dominated between the drains. Flow is significant in the double drain to the SE at the SE end. The most southerly of the recent N/S drains has flow to the SW with stagnant water in the remainder of the N/S drains. The most south-westerly of these drains (bS) is longer than the others and old and infilled with *Myrica* and *Calluna* with *Betula* encroaching along it. It follows a townland boundary. Between it and the rest of the drains *Molinia* with patches of *Myrica* and *Melampyrum* are colonising.

Drain Complex bU is a similar series of drains to those of Drain Complex bN and may be seen to the NW of Drain bA. There are approximately 60 NE/SW drains varying in length from 215m to 350m. The drains have been extended further into the centre of the bog since the 1993 aerial photograph. There is significant water loss from them to the SW to the bog edge. A long drain runs N/S at the east of the complex.

Drain bO is an old infilled drain at the E of the site and runs N/S. A *Calluna* dominated ridge is seen along its length.

Drain bP is an old infilled drain which runs NNE/SSW parallel to the SE edge of the bog. Scattered *Betula* and *Pinus sylvestris* may be see growing along it and *Molinia* encroaches about 30m along its SE end.

Drain bQ is a small network of drains seen at the SE corner of the site which is associated with difco peat cutting. The drains are 0.5m wide by 0.1m deep and are bare of vegetation. They contain some water.

Drain bR is an old infilled and non-functional drain.

Drain bT is seen at the E of the site. It is old and infilled with *E. angustifolium, E. vaginatum, S. cuspidatum* and *S. magellanicum*. It appears to be non-functional.

5.2.2 Bog Margin Hydrology

North East

Deep face drains move water to the north and are 2m deep and 1.5m wide. The cut-away area near drain mC is hopper but is rather disordered. Drain mC is a newly deepened drain and up to 4m deep. The high bog is collapsing into it (PM11:31 to the S) and there is further cracking and slumping. Cuttings show till on clay. There are high facebanks 4m, at drain mD.

North West

There is a small area of old peat faces along the NW side where cut-away drains are infilled and main drain mE is stagnant but with a high EC.

There is active peat-moss cutting in a large block between drain mB and bA. A large amount of water leaves the high bog at this point and moves into the cut-away via drains mB and mG. However, drain mB2 to the W of the site is almost dry at the bog edge with *Blechnum, Narthecium, C. echinata, C. diandra, Lemna, Lythrum salicaria, C. lepidocarpa, Pteridium, Menyanthes, Potentilla erecta, P. palustris, Rubus, Ranunculus flammula, Lonicera, Plantanthera, Dactylorhiza maculata* and *Anagallis tenella*. Drain mG is 3m deep and 1.5m high in clayey till.

West

Two main drains in parallel move water NW from the lower western side. One drain is on the high bog (mH2) and in peat, and the other is at the bog margin (mH1) in mineral soil. There is a small ridge to the immediate west of drain mH1 where there is local extraction of gravels at a small pit.

South East

There are old faces near drain bQ with no active cutting. All faces show *Phragmities, Typha* and *Ulex.*

Moving NE along this side there is intensification of peat cutting and drainage. Drains are newly deepened and separate this bog from Ballyduff bog. They are 2.5m wide and 1m deep and all lie in stony till.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map).

North East

Drains in the NE cut-away show elevated ECs ranging 230-550μS/cm.

North West

The electrical conductivity of drain mE was ~700μS/cm. The EC range is 240-660μS/cm near drains mB.

5.3.2 Laboratory Hydrochemistry

No samples were taken for analysis at the Coillte laboratory.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
Clonfinane bog lies in a regional groundwater recharge zone and is situated at the top of a surface water catchment divide. The underlying limestone aquifer has a low permeability and hence the water-table in this area would be relatively close to the surface.

Bog Regime
This bog has relatively deep drains around all the edges with relatively high electrical conductivity values. Hopper peat cutting occurs to the north and intensive peat-moss extraction is ongoing in the NW. Overall the bog suffers from heavy drainage and it is cut-off from its sister bog Ballyduff by a sequence of deep drains and peat extraction.

Inter-relationship
It is believed that Clonfinane bog lies in a former lacustrine basin which received glacio-fluvial inputs of sands and gravels from the west. Groundwater discharges artificially in the deep marginal drains.

6. VEGETATION

6.1 VEGETATION SUMMARY

The sub-marginal and NW section of this site are dominated by *Narthecium* flats with *Calluna* and *E. vaginatum* common. The wettest area is seen in the centre of the SE section of the site and covers approximately 10ha. Here large linear *S. cuspidatum* pools occur containing species such as *Drosera anglica* and *Menyanthes* occur. The surface is wet here and there is a deep acrotelm layer. To the NE of this wet area a slightly drier section occurs. Pools are still seen but at lower frequencies. One large *Pinus sylvestris* flush occurs on the high bog with typical woodland species and a circular *Betula* woodland is seen at the SSW of the site also on the high bog. *Pinus sylvestris* trees and seedlings are scattered over a large proportion of the site. Along the NE edge *Phragmites* is commonly seen on the high bog. It is possible that the peat is shallow in this area.

The vegetation of the old cut-away area to the W of the site is dominated by *Molinia* with *Calluna* closer to the bog edge and the facebank is up to 2m tall. At the NW corner there is active peat cutting and the facebank is up to 3m tall. The old peat cutting area is dominated by *J. effusus, E. angustifolium* and *Molinia* with *Pteridium* and *Betula* behind. There is some *Typha* in the drains. To the N of the site there is some old and active peat cutting. There are very deep new drains associated with the active peat cutting. In the older areas towards the mid N there is scattered Pine, *Betula, Calluna, Molinia* and *Phragmites*. The facebank is up to 1m tall. Marginal drains in this area are infilling with *S. cuspidatum, S. auriculatum, S. papillosum* and *E. angustifolium*. There is extensive active peat cutting in the NE corner with much bare peat. The vegetation of the old cut-away along the ESE edge is dominated by *Betula, Ulex, Calluna* and *Phragmites*.

Along the NE bog edge and in a small area to the NNW mixed deciduous (mainly *Betula*) and Pine woodland occurs. A *Pinus sylvestris* dominated woodland is seen to the E of the site, adjacent to Ballyduff bog. Along the SE side of the bog *Ulex* scrub grows. The SW edge of the bog has been drained extensively. Along the S of the SW edge there is a narrow hedgerow, a mixture of *Betula, Ulex* and deciduous woodland, behind which agricultural fields are seen. Further N there is a broader band of mixed woodland.

Near the access point at the NE of the site, an area of old peat cutting is dominated by encroaching pine, *Betula, Pteridium, Phragmites* and regenerating peat and the old drains are infilling with a range of Sphagna (PM11:32).

Along the access track the following species are seen: *Corylus, Ilex, Salix, Betula, Sorbus aucuparia, Fraxinus exelsior, Fagus sylvatica, Rhamnus catharticus, Viburnum opulus, Crataegus, Quercus* and *Taxus baccata* with *Pteridium, Ulex* and *Phragmites*.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

The facebank complex dominated by *Calluna* and *Hypnum jutlandicum* is seen in various places around the site. It occurs all around the edges of the NW lobe (apart from the moss peat production area) and it is particularly well developed on the SE side where the *Calluna* reaches 1.5m in height with pine and *Betula* seedlings invading from the cut-away. *Pteridium, Molinia* and *Betula* encroach along the N edge. It also occurs along the northern edge of the site, N of the *Phragmites* complex at the edge of the *Betula* dominated woodland. Here *Molinia, Myrica, Pteridium, Pinus sylvestris* and *Betula* encroach into this complex. At the south of the eastern edge of the site the *Calluna* in the facebank complex reaches 0.8- 1m in height with some *Phragmites* and *Hylocomium splendens* also present. Around the circle of *Betula* trees at the SW of the site this complex also grows with the addition of *Phragmites, Molinia* and *Potentilla erecta*. This complex is also seen along the edges of older drains.

Complex 1/2

A small area of vegetation dominated by *Calluna* and *Trichophorum*, with frequent *Carex panicea*, is seen at the SE side of Drain bA. It is hard underfoot and there are areas of bare peat (15%) which are probably surface water run-off features. This area appears to have been burnt in the past. This is supported by the fact that Flush Y, just to the SE, shows evidence of burning. There is no acrotelm layer.

Complex 2

This is seen at NW corner of the northern section of the site close to the bog edge and is associated with Slope 1. *Trichophorum* dominates (35%) and there is 20% bare peat with *Calluna, Erica tetralix* and *Carex panicea* making up the rest. *Campylopus introflexus* is seen on the bare peat areas. *Sphagnum* cover is low and there is no acrotelm layer. Another area of the complex is seen at the NE edge in association with Slope 4.

Complex 3

This is seen close to the NE edge immediately S of Drain/Track bA and has been burnt. The vegetation is dominated by *C. panicea*.

Complex 2/6

This is seen in the SE corner of the northern third of the site and is associated with the gentle Slope 5 to the S and an area of old peat cutting. To the E of the complex there are deep drains associated with active peat cutting and there is some slumping of the bog surface into them (PM11:31). The vegetation is dominated by *Trichophorum* and *Narthecium* with the *Trichophorum* increasing towards the edges. There is no facebank complex at the edges though the % cover of *Calluna* increases towards the S. *Betula*, pine and *Myrica* are encroaching at the S edge.

Complex 6/2

This is close to the SE side of Drain bA and between Drains bJ and bM at the SE of the site. A burning history is suggested as *Calluna* has only about 10% cover and there is no *Cladonia portentosa*. Another patch of this complex occurs close to Drains bJ and bK at the E of the site.

Complex 7+ *Cladonia* and *Myrica* (+*Cl*+*My*)

This complex is dominated by *Calluna* (35%) up to 50cm tall in places. It is seen close to the SE side of the circular *Betula* copse. There is 25% cover by *Cladonia portentosa* with scattered *Myrica* and *Melampyrum*. *E. vaginatum* tussocks occur throughout with some *E. angustifolium* and

Trichophorum. The *Sphagnum* cover is poor with just a few *S. capillifolium* hummocks and there is no acrotelm layer. Algal hollows also occur, some with *R. alba* and occasionally *S. cuspidatum*.

Phragmites Complex

To the N of Drains bE and bG an area of vegetation dominated by *Phragmites, Eriophorum vaginatum* and *Calluna* with scattered *Betula* and *Pinus sylvestris* occurs (PL12:6 and 7). To the W of Drain bF it is very dry and hard underfoot with evidence of past burning. There is some *Sphagnum* cover, made up mainly of *S. capillifolium*. *Molinia, Myrica* and *Melampyrum* occur throughout with *Narthecium, Carex panicea, Trichophorum* and *Erica tetralix* also present (PM11:34+36). Mature *Betula* woodland occurs along the bog edge here and *Pteridium* and *Molinia* are invading in places. An electric fence runs along the bog edge. Just W of Drain bF the *Sphagnum* layer is noticeable with taller *Calluna* and the *Cladonia portentosa* cover is 5%. This area was probably not burnt. The area to the east of Drain bF does not appear to have been recently burnt either as the *Cladonia portentosa* cover is 35%. *Calluna* and *E. vaginatum* dominate with scattered *Phragmites* and patches of *Myrica*. The surface is still hard underfoot. It appears that this area is situated on a mound of till which may extend south-westwards under Flush Y.

Sub-Marginal Complexes

Complex 6

This is one of the dominant vegetation complex at this site. It covers most of the northern section of the site and parts of the southern section. It is characterised by a high frequency of *Narthecium* hollows (35%) and a low-moderate *Sphagnum* cover (20%). *S. capillifolium* (some large, low hummocks) is the most abundant Sphagna (10%) with some *S. imbricatum* (5%), *S. subnitens* (5%) and small amounts of *S. tenellum, S. magellanicum* and *S. papillosum*. *S. fuscum* was seen at the NE of the complex close to Slope 4. *Leucobryum glaucum* hummocks also occur. *Calluna* (30-40cm tall) (typical hummocks 25%) and *Trichophorum* (10%) are frequent with small amounts of *Carex panicea* throughout (PM11:29). There are some small hollows containing algae, *S. cuspidatum, R. fusca* and *S. auriculatum* (3cm of water in some hollows). The *Cladonia portentosa* cover is low (5%). The western indicator *Racomitrium lanuginosum* was seen growing in small patches in the *Narthecium* flats. *Huperzia selago* was also seen here and close to drain bN. Although the *Sphagnum* cover is low the bog surface is soft where this complex occurs and an acrotelm layer is present.

On the northern section of the site a number of *Pinus sylvestris* trees grow on the high bog in this complex (see vegetation map P1-P7). The vegetation noted under these is described below. A number of seedlings occur at low densities over much of the northern third of the bog.

P1 and P2 mark two *Pinus sylvestris* trees close to the bog edge at the SW of the northern section of the site. There are seen on a shallow slope to the bog edge and *Carex panicea* becomes more frequent in this area.

P3 is a single Pine tree with *Calluna* (1m), *E. vaginatum, S. papillosum, S. capillifolium, S. fimbriatum, Aulacomnium palustre, Hypnum* and *Dicranum* growing underneath.

P4 consists of a *Pinus sylvestris* tree (8m) with numerous seedlings from 10cm to 1m in height which have spread about 15m from the parent tree. Under the main tree the following were recorded: tall *Calluna* (1m), *Eriophorum vaginatum, Vaccinium oxycoccus, S. papillosum, Hypnum jutlandicum, Pleurozium schreberi, Dicranum scoparium* and *Aulacomnium palustre*.

P5 is a group of 3 pine trees and approximately 30 seedlings. *Calluna* (1m), *Sorbus aucuparia* seedling, *E. vaginatum, S. papillosum, S. capillifolium, Hypnum jutlandicum* and *Pleurozium schreberi* were seen under the trees.

P6 is a *Pinus sylvestris* tree with *Betula* and *Sorbus aucuparia* seedlings. *Calluna, E. vaginatum, Holcus lanatus, Dryopteris dilatata, Dicranum scoparium* and *S. capillifolium* were also present.

P7 consists of an 8m tall pine with numerous seedlings concentrated on the NE side and some *Betula* scrub.

Where this complex is seen next to Drain bN1 is probably is a dried out form of 10/6 due to the effect of the network of drains as there are still traces of dried out pools. The surface is still soft.

Close to Flush Y, the cover of *E. angustifolium*, *E. vaginatum* and *Trichophorum* increases and there are patches of *C. panicea*. *Calluna* cover decreases and there are some dried out pools. *Campylopus introflexus*. The area was probably associated with the burning event which affected Flush Y (PM11:34+PM12:6).

Complex 6+ *Cladonia*

This is seen in a broad band at the SE and E of the site and along the northern edge S of Drain bE (PM12:17). It is similar to complex 6 as it has a high frequency of *Narthecium* flats (20%) but the *Cladonia portentosa* cover is moderate (20%) and the *Calluna* cover is higher and plants are taller (typical hummocks 40%) indicating that it has not been burnt for some time. The total *Sphagnum* cover is rather low (10%) but the surface is still spongy and there is an acrotelm layer present. *Racomitrium* and *Pleurozia purpurea* were seen in this complex, the latter in significant amounts. Occasional *S. cuspidatum* pools occur but these were dry at the time of the survey and algal hollows were more common (10%). At the E of the site *E. vaginatum* cover increase to 40% in this complex.

A *Pinus sylvestris* tree is seen at the junction of this complex and Complex 15. P11 is a tall *Pinus sylvestris* tree (4m) surrounded by approximately 30 pine seedlings. *Calluna* (80cm), *E. vaginatum*, *E. angustifolium*, *Vaccinium oxycoccus*, *Erica tetralix* and *Andromeda* were noted. The bryophyte layer was made up of *S. papillosum*, *S. capillifolium*, *Hypnum jutlandicum* and *Aulacomnium palustre*.

To the S of P11 there is a higher frequency of algal pools, some containing *E. angustifolium*. They are mostly dry.

Another large *Pinus sylvestris* tree and a *Betula*, with *Betula* and *Pinus* seedlings are seen at the N side of this complex (P8). *Calluna* (70cm), *E. vaginatum*, *Molinia*, *Hypnum*, *Hylocomium splendens*, *S. papillosum*, *S. capillifolium* and *S. tenellum* are seen here. Mats of *Vaccinium oxycoccus* occur growing over the *Sphagna*. *S. subnitens* and *S. imbricatum* dominate just around the trees and *Pleurozia purpurea* was common. Just to the N of P8 there is an area with *R. fusca* hollows and some *Menyanthes*.

A small circular *Betula* woodland with *Betula* up to 20m tall occurs to the south of the complex (PL12:18 to S). It is shown as scrub on the 1910 6" sheet. *Fraxinus*, *Sambucus*, *Ilex*, *Hedera*, *Lonicera*, *Rubus*, *Sorbus aucuparia* and other woodland species also occur here. The cover of *Cladonia portentosa* increases to 70% close to the woodland. A shallow drain is seen on the N side of this woodland and *Sphagnum squarrosum* was seen in it.

Complex 10/9

To the NE of the circular *Betula* woodland there is a very small patch of this complex. There are some *S. cuspidatum* hollows and *S. magellanicum* with abundant *E. vaginatum* and *E. angustifolium*. It appears to be a slightly sunken area where water ponds.

Sub-Central Complexes

Complex 6/10

A small wet area occurs just S of the active peat cutting on the NE side of the northern section of the bog. This area appears to be slightly sunken. Drain bD runs through this area and it may have developed due to subsidence associated with the drain. The total *Sphagnum* cover is high (60%), mainly *S. magellanicum*, *S. papillosum* and *S. cuspidatum*. The *S. cuspidatum* in seen in small lawns/hollows and there is abundant *E. angustifolium* (40%) which was fruiting well. *Narthecium* also occurs (10%) with some *Drosera anglica*, *R. alba* and *Vaccinium oxycoccus*. To the SW of Drain bD there are some larger *S. cuspidatum* pools. These had a low water table at the time of the survey but there is evidence of it being higher at other times. *Eriophorum vaginatum* is more common here (20%) and the cover of *E. angustifolium* is lower. This is definitely an area where water ponds.

Complex 10.6
This forms the sub-central complex of the south-eastern section of the site (PM12:4). It is dominated by *Sphagnum* and *Narthecium* lawns (15%). The total *Sphagnum* cover is 40% with 10% cover by S. imbricatum (50cm tall in places) hummocks (PM12:5) with *S. fuscum, S. capillifolium, S. magellanicum* (5% hummocks and 5% lawns). *S. subnitens* (5%) and *S. papillosum. S. cuspidatum* and *Menyanthes* pools/lawns make up 20% and are broad and large with about 5cm of water at the time of the survey. They do not appear to be aligned in any direction. The pools also contain *S. papillosum, S. auriculatum, R. alba* and *Drosera anglica*. The typical hummock cover is high (35%) and there is a good topographical structure. *Pleurozia purpurea* was seen in this complex on a *Narthecium* flat. The whole area is wet and spongy with a well developed acrotelm layer.

A number of pines are also seen in this complex, namely P9 and P10.

P9 is a group of 5 *Pinus sylvestris* trees (3-4m tall) with *Calluna* (80cm), *Andromeda, Luzula, Narthecium, E. vaginatum, E. angustifolium, Trichophorum, Holcus lanatus, S. palustre, S. papillosum, S. fimbriatum, S. capillifolium, S. imbricatum, Aulacomnium palustre* and *Hypnum jutlandicum.*

P10 is a group of 20 *Pinus* approximately 2.5m tall with *Calluna, Juncus effusus, E. vaginatum, Menyanthes, Erica tetralix, Vaccinium oxycoccus, Narthecium, Andromeda, Empetrum, S. papillosum, S. magellanicum, S. imbricatum, Aulacomnium palustre, Hylocomium splendens* and *Pleurozium schreberi*. A number of pine seedlings surround the main group.

Central Complex
Complex 15
This is the wettest central complex of the high bog (PL12:20-22). The total *Sphagnum* cover is 40% with 10% *Sphagnum imbricatum* hummocks (up to 50cm high), 5% *S. papillosum* and small amounts of *S. subnitens, S. magellanicum* and *S. capillifolium*. Small *S. fuscum* hummocks are also seen. *Leucobryum* hummocks up to 1m high may be seen. There is a 20% cover of *S. cuspidatum* pools, which also support *Menyanthes, R. alba, E. angustifolium* and *D. anglica*. Some pools are linear with a SE/NW orientation and others are circular. To the S of P12 pools are aligned SW/NE and are up to 10 m long in places. Close to P12 *Pleurozia purpurea* was seen. There is 35% cover by typical hummocks with *Calluna* reaching 40-50cm in height, topped by *Cladonia portentosa.*

A group of approximately 11 *Pinus sylvestris* trees is seen in this complex at the S side (P12). The trees are around 4m tall with numerous seedlings. *Calluna* (80cm), *E. vaginatum, E. angustifolium, Vaccinium oxycoccus, Holcus lanatus, Anthoxanthum, Dryopteris dilatata, Betula scrub, Potentilla erecta, Luzula* and *Andromeda* were noted. The bryophyte layer was made up of *S. papillosum, S. capillifolium, S. palustre, S. tenellum, Hypnum jutlandicum* and *Aulacomnium palustre*. Large lawns of *S. cuspidatum* surround this feature.

Close to Drain N1 two groups of pines are seen at the junction of this complex and Complex 6/15 (a dried out version of 15).

P13 consists of two *Pinus sylvestris* trees (7m tall) and a *Betula* with *Calluna, Vaccinium oxycoccus, Holcus lanatus, E. vaginatum* and *Luzula*.

P14 is a *Pinus sylvestris* (3m tall) with *Calluna* (80cm), *S. imbricatum, Dicranum, S. capillifolium* and *Hypnum*. A dried out *S. cuspidatum* and *Menyanthes* pool is present in the vicinity.

6.2.2 Flushes
Flush Z is a group of *Pinus sylvestris* trees up to 5m tall. Pine seedlings, *Calluna, Vaccinium myrtillus, V. oxycoccus, Sorbus aucuparia, E. vaginatum* tussocks, *Juncus effusus, S. papillosum, S. capillifolium*, and *Aulacomnium palustre* are seen under them. To the SE of this flush some pools infilled with *S. magellanicum* are seen, which also contain *Menyanthes, R. alba, Drosera anglica* and *E. angustifolium*.

Flush Y is a large *Pinus sylvestris* dominated flush seen to the SW of Drain bA. It is shown as a coniferous woodland on the 1910 and 1840s 6" sheets. The pine trees reach up to 10m in height with an understorey of mainly *Betula* (1-3 m), *Calluna* (50 -80cm) and pine seedlings. There is evidence of past burning shown by burnt tree trunks (PM11:33). Other tree species seen here were *Quercus robur, Salix, Sorbus aucuparia* and *Ilex* with other species such as *Phragmites, Vaccinium oxycoccus, V. myrtillus, Hedera, Lonicera, Rubus, Molinia, Empetrum, Luzula, Juncus effusus, Epilobium angustifolium, Dryopteris dilatata, Dactylorhiza maculata, Eriophorum vaginatum* and *Anthoxanthum odoratum*. The bryophyte layer was dominated by the following species: *S. capillifolium, S. magellanicum, S. papillosum, Aulacomnium palustre, Polytrichum commune, Dicranum* and *Pleurozium schreberi* (PM11:32 to NW and PL12:5 to SW). *Phragmites, Molinia* and *Betula* extend in a tail to the SE from this flush.

A palynological, macrofossil and stratigraphical investigation was undertaken at this flush by O'Connell (1990). She discovered that the pine flush is a recent phenomenon and not an ancient woodland remnant. It probably became established on the site of a *Betula* flush after a fire event. In addition to the species recorded during this survey, O'Connell noted the presence of *Taxus baccata* in the present day flush.

Stratigraphical evidence showed that only 2.9m of peat occurs beneath the flush, under which lake marl was noted.

7. BOG TYPE

This bog has been classified as a Ridge River B bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes

A number of these slopes were estimated in the field. They are described below and their positions are shown on the Slopes Map.

Slope 1 This is seen at the NW of the site close to the area of active peat cutting on the high bog. The slope into old peat cutting and a marginal drain (2.5m below bog) is 1m over 50m with cracking and slumping of the bog surface.

Slope 2 At the NW corner the slope from the high bog towards a marginal drain and old peat cutting is 0.5m over 30m.

Slope 3 At the N edge of the NW third of the bog the slope into active peat cutting is 0.5m over 30m with cracking and slumping of the peat surface.

Slope 4 Slightly SE of Slope 3, the slope from the high bog into active peat cutting is 0.75m over 40m. The facebank is up to 4m high here. There is evidence for surface water run-off through this area.

Slope 5 The slope at the SE corner of the northern third of the bog into old peat cutting is 0.25m over 30m.

Slope 6 At the SE side of the northern third of the site the slope from the NW into Drain bA is 0.5m over 100m.

Slope 7 At the S of the site into old peat cutting the slope is 0.3m over 30m

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat cutting

Peat cutting is being carried out extensively around this site. All along the south-western edge exploitation for moss peat is occurring. A series of NE/SW drains have been installed in connection with this development. Peat is being removed in large sods and exported to The Netherlands by a company called Premier Peats (PL12:2 to SSW). Since the aerial photography was taken in 1993 this exploitation has been extended further into the centre of the northern third of the bog .

Along the NW and N (PL12:3) edges of the northern third of the site active peat cutting is occurring, mainly using the hopper method of extraction. Machine tracks are seen on the high bog in the vicinity of this peat cutting. Very high facebanks (up to 4m) are seen in places (PM11:30 at the NE close to Slope 4). New very deep drains (3-4m) have been inserted at the bog edge and the high bog is collapsing into them (PM11:31). Another development is occurring at the ENE corner of the site. Large drains have been dug and pits have been excavated in the peat. They may have been looking for more humified peat as much of the peat in this area is quite poorly humified. It appears that peat is being exploited using mainly the hopper method but there is also some Difco cutting. Old Difco cutting has been carried out on the SE side of the site close to the circular copse of trees on the high bog and more recently at the E of the site to the E of Drain bM (PL12:3), where new deep drains (Drains bJ and bK) have been recently excavated and deepened on the high bog.

8.2.2 Forestry/Woodland

Along the N edge of the main lobe of the bog mixed deciduous woodland with some pine occurs. A woodland to the N of this is shown on the 1910 6 " sheet of the area and is called Lumcloon wood. This has now been cut but these trees may be remnants of that woodland. At the NE of the site mature *Betula* woodland is seen (PM11:36). At the southern corner of the site a circular copse of mainly *Betula* with some other deciduous trees species occurs (shown on the 1910 and 1840s 6" sheets) (PM12:17). A badger sett was seen in this woodland.

8.2.3 Fire History

Flush Y shows evidence of being burnt in the past. This is shown by burnt pine trees. This fire may have spread from Drain bA as the vegetation in this area indicates a fire history. Complexes 6/2 and 1/2 have short *Calluna*, patches of bare peat with an algal film and *Campylopus introflexus*, which all indicate disturbance of the area which may have been due to fire.

8.2.4 Cattle Poaching

Poaching by cattle has occurred between the double drain bA where access is easy from the cut-away onto the high bog.

8.2.5 Agricultural Improvements

Some field development has been carried out since the 1970s to the NW of the bog on cut-away peat. Fields have also been created on cut-away peat to the NE of the NW Lobe where scrub can be seen on the 1970s aerial photograph. The scrub has been cleared and drains have been inserted. Some of this area was shown as woodland on the 1910 6" sheet and therefore may not be cut-away peat.

8.2.6 Dumping

There is some dumping of rubble along an old track to the NE of the site.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. The *Pinus sylvestris* and *Phragmites* dominated Flush Y is associated with underlying mineral soil.

2 The area of *Phragmites* along the NE edge is associated with underlying limestone bedrock. This is an infiltration lagg. There is also an area of potential lagg on the SW side of the site.

3. The spread of Pine trees onto the high bog may suggest drying out.

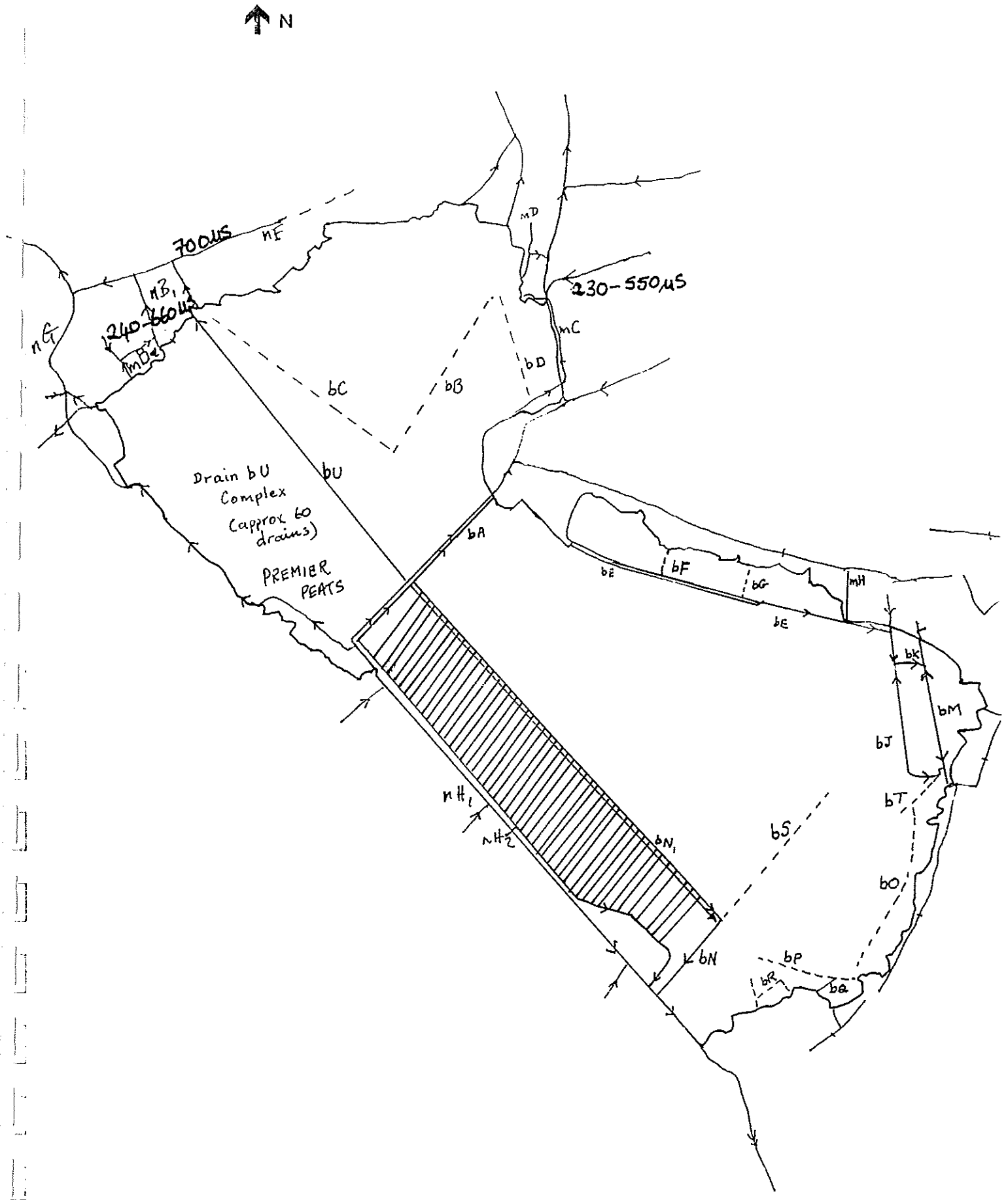
4. On the NW section of the site the wetter areas are confined to subsidence hollows.

5. The western species *Pleurozia purpurea* and *Racomitrium* were recorded on this site indicating some oceanic influence.

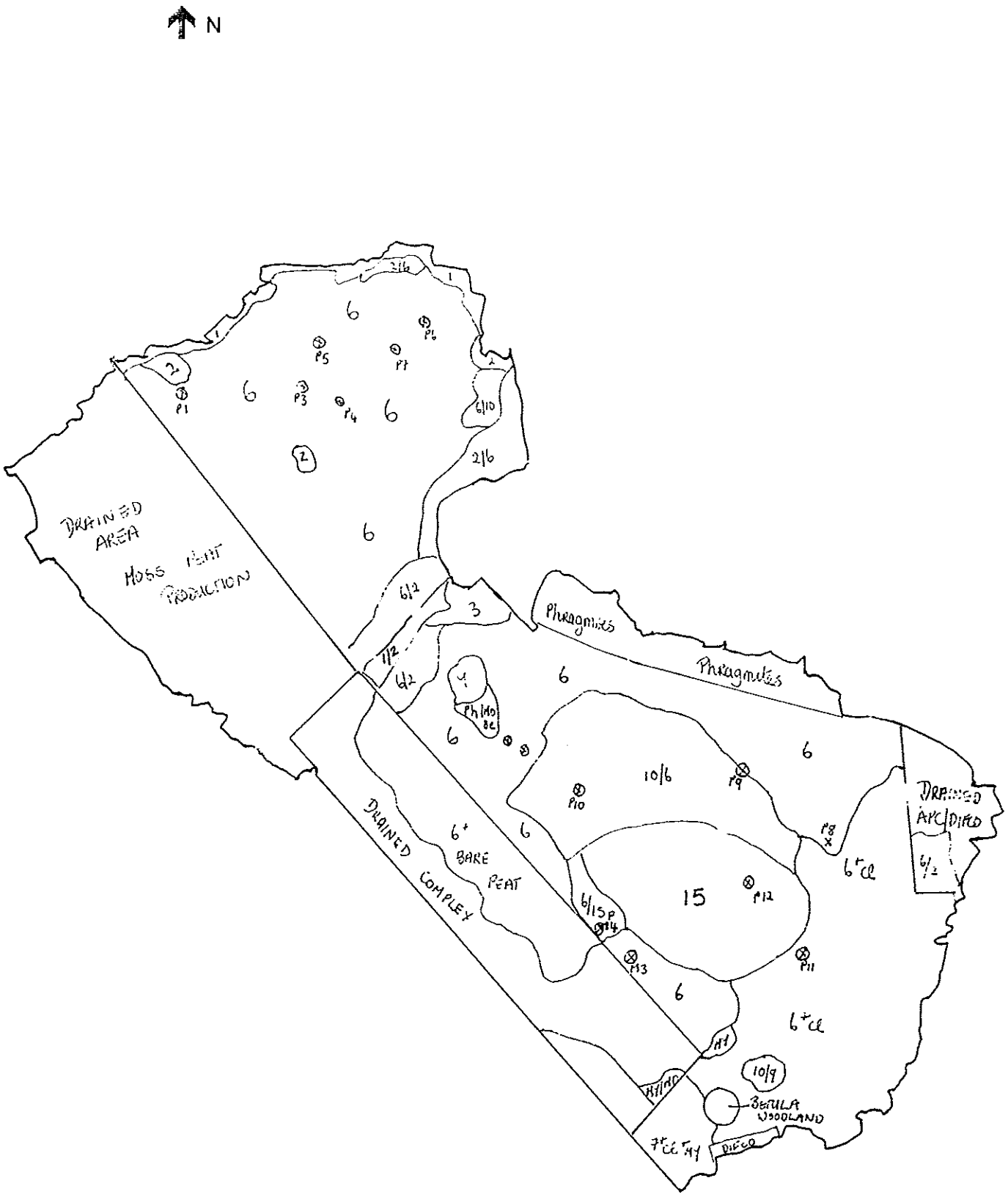
Lara Kelly
Malcolm Doak
Marie Dromey

Raised Bog Restoration Project (1995).

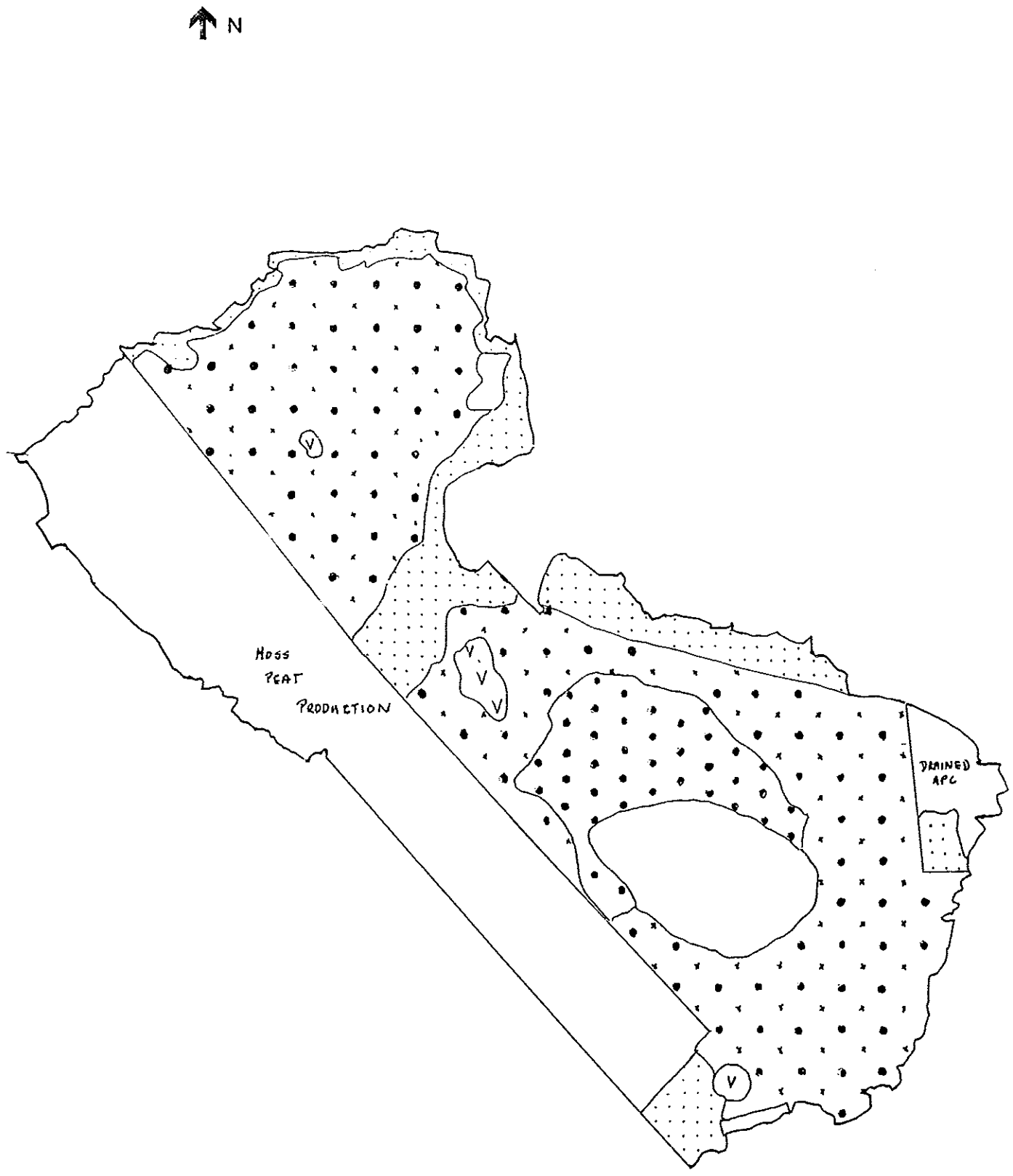
CLONFINANE BOG, CO. TIPPERARY (641).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994



CLONFINANE BOG, CO. TIPPERARY (641).
VEGETATION MAP (1:10,560)
1994

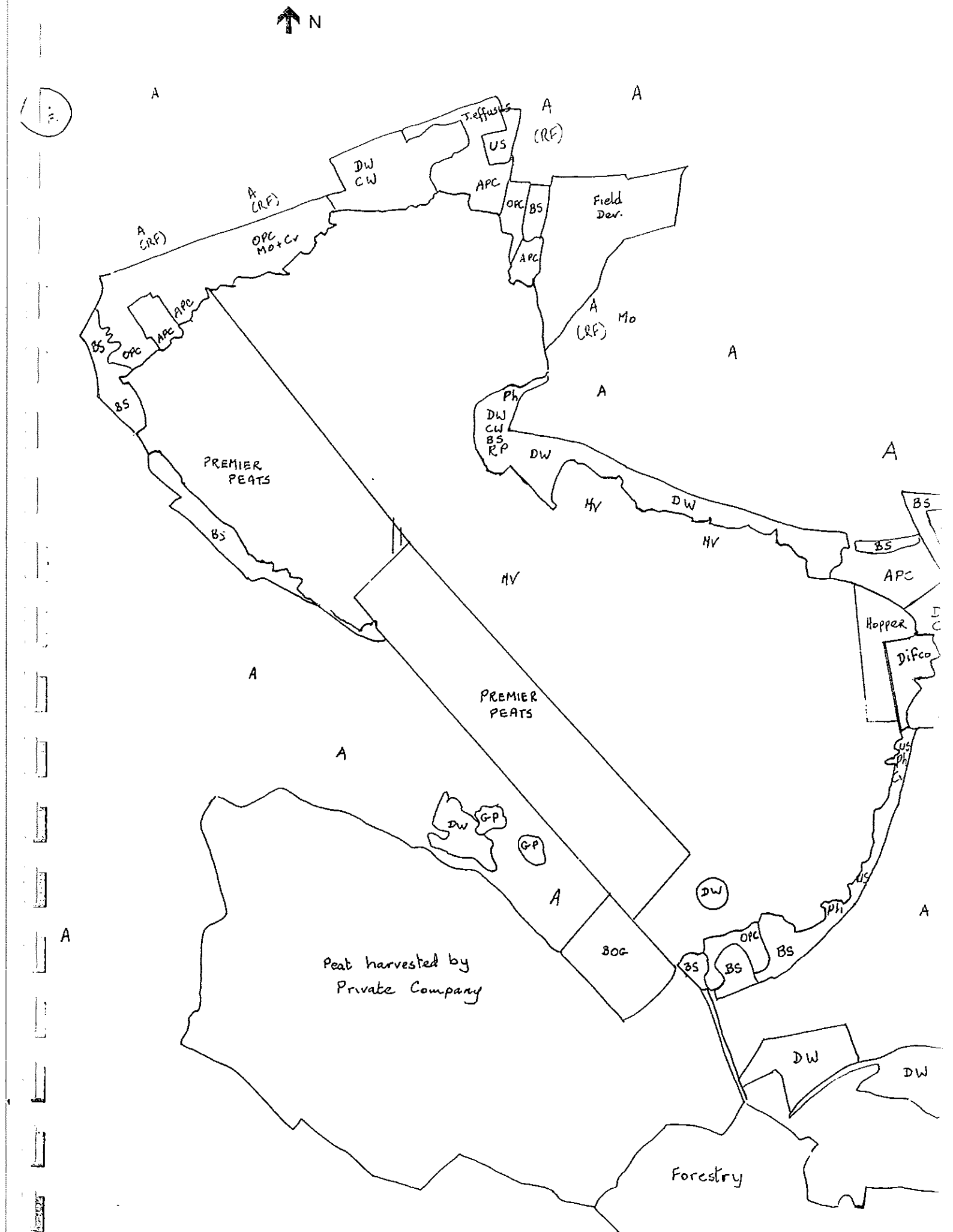


CLONFINANE BOG, CO. TIPPERARY (641).
ECOTOPE MAP (1:10,560)
1994



CLONFINANE BOG, CO. TIPPERARY (641).
SLOPES MAP (1:10,560)
1994

CLONFINANE BOG, CO. TIPPERARY (641).
LANDUSE MAP (1:10,560)
1994



CLOONCULLAUN, CO. GALWAY

1. SUMMARY OF SITE DETAILS

NHA No.	245	1/2" Sheet:	12
Grid Ref:	M 70 59	6" Sheet:	GY 18,19 and 31
GSI Aerial Photo:	M 162	1:25,000 Sheet:	17/25
NHA Photo:	649:17-24 & 649:32-33	Area (ha):	130 (High Bog)
Date(s) of Visit:	8-9-94 (Ecology) 8-9-94 (Geohydrology)		

Townlands: Clooncullaun, Knockmascahill and Timacat.

2. INTRODUCTION

2.1 BACKGROUND

This site was surveyed by Douglas and Grogan (1985). They describe the vegetation as being dominated by *Calluna* and Cyperaceous plants with a low *Sphagnum* cover. However the surface was quite wet and spongy. Much of the bog had been damaged by fire in the past. To the N small narrow pools were noted, many of which were un-vegetated. They also noted a small soak on the W Lobe. The conservation value of the site was not thought to be very high.

The bog was given a Bii status and was not included in the list of sites drawn up by Cross (1990). Despite this Clooncullaun was visited as part of this survey as a large portion of the site was available from Bord na Mona and the purchase of the site was in progress.

Clooncullaun was also visited as part of the NHA survey (11994). It was suggested that the site should be designated as an NHA with regional importance. In the NHA report the site is described as a large expanse of undisturbed uniform vegetation, though burning of the site has occurred in the past. The drying out of the southern section of the site was highlighted.

2.2 LOCATION AND ACCESS

Clooncullaun is situated approximately 8km SE of Glennamaddy, Co. Galway. Camderry bog lies immediately to the SE of this site. They are separated from each other by a stream.

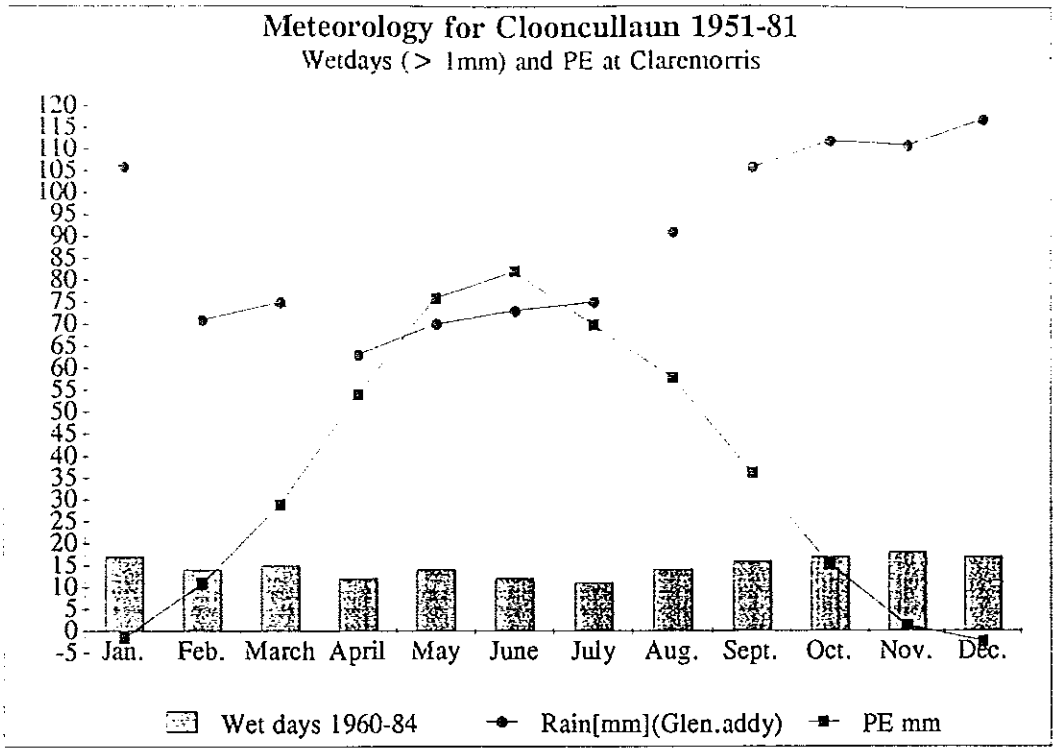
Access may be obtained at the S of the bog where an old trackway extends N/S through the centre of the southern section of the site. This bog road may be accessed from a small road to the E. However a deep drain has been dug across this road so care should be taken.

3. METEOROLOGY

No meteorological measurements have been made on Clooncullaun bog. Rainfall data from the nearby Glennamaddy rainfall station for the years 1951-80 indicate that the area receives an average 1069 mm of precipitation annually (Fig. 11). The nearest Meteorological Service synoptic station at Claremorris suggests that the site could have up to 234 rain days and up to 177 wet days annually.

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

Figure 11:



The above factors suggest that the year round actual evapotranspiration (AE) from Clooncullaun Bog is greater than PE at Claremorris, site of the nearest synoptic station which had an average PE of 428.1mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Clooncullaun would therefore be greater than 428.1mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 641mm/yr.

Meteorological data for Clooncullaun Bog (1951-1981) are summarised below:

Rainfall (P)	1069 mm/yr
Actual Evapotranspiration, (AE)	>428.1mm/yr
Potential recharge, (PR)	<641mm/yr
Raindays > 0.2mm (annual {1951-80})	234 days
Wetdays > 1mm (annual {1960-1984})	177 days

Rainfall analyses up to 1991 for the Glennamaddy area show that late winters (January, February, March) have become progressively wetter over the past 20 years and those of the last years have been wettest of all.

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

Clooncullaun is a western or intermediate raised bog and therefore has a more variable topography than the typical raised bog and has no central dome. The whole site slopes southwards with the northern edge of the site approximately 3-4m higher than the south. The 300 foot contour line runs through the centre of the site, and the bog has an average height of 92m O.D. There is also a slope towards the W on the NW Lobe. In addition there are slopes into the bog road which runs up the centre of the site, slopes into Flush Y, undulating land form along the WNW edge associated with old drains (PM17:8) and marginal slopes associated with peat cutting and drainage.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

At the macro scale Clooncullaun bog is situated on the slope of a plateau to a drumlin filled valley. To the north there is a plateau of high ground. The bog is located immediately N of Camderry bog, and 2.5km E of Lough Lurgeen Bog. There are drumlin ridges to the SW and SE of the site.

5. HYDROLOGY

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Smith, show that the area is probably underlain by cherty argillaceous bioclastic Carboniferous limestones (known as ABL). The Old Red Sandstone Mount Mary inlier lies 4km to the south-east of the site.

The ABL fossiliferous limestones generally have a low permeability and are classed as a poor aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

No subsoils data were available for Clooncullaun bog apart from the initial 1840s GSI geology field sheets, and recent fieldwork carried out for this study.

Geology of Inorganic Subsoils

The subsoil geology of this bog and surrounding area is dominated by a clayey/silty limestone till with some sandstone clasts. The Shiven River to the SW is in till which has a variable clay to silt matrix.

Peat

The black line on the enclosed photocopy of the Geological Survey map produced in the 1840s indicates the original extent of the bog.

5.1.3 Depth to Bedrock

Depth to rock at/on the bog is unknown.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology (See Drains and Hydrochemistry Map)

Drains bA are seen on either side of the ecntral track. Drain bA1to the NE of the track is 0.5m wide by 1.25m deep with an EC of 160 µS/cm. Flow was not detected. *Salix, Ulex, Rubus* and tall *Calluna* are seen along it. At the S end of Drain bA (EC 99 µS/cm) the following species were noted: *Molinia, Filipendula, Potentilla anserina, P. erecta, Succisa, Centaurea, Stachys palustris, Rubus fruiticosus, R. idaeus, Anthoxanthum, Cirsium palustre, Angelica, Heracleum, Sonchus, Arrhenatherum, Ulex, Equisetum palustre, Dryopteris dilatata* and *Pteridium* (PL16:25 to the S).

Drain bA2 at the N end supports *Typha* and there is very rapid flow to the S. The EC is 79 µS/cm.

Drain bB is a very old non functional drain which runs NE/SW through the NE lobe of the bog. It is not possible to see this drain in the field. However, a patch of *Myrica* near the NE end with a patch of *Molinia* at the end point to its NE course. There is also a patch of *Myrica* and *Molinia* at the SW end.

Drain bC at the NE of the site was marked on the 6" sheet and was visible on the 1970s aerial photograph. Today all that remains is a short erosion channel. Peat cutting has reduced the length of the drain.

Drain bD also to the NE of the site is 0.2m wide with a high water table and some *S. cuspidatum* patches. The drain is blocked off at the NE end due to disturbance caused by active peat cutting.

Drain bE shown on the 6" sheet and visible on the 1970s aerial photograph was not seen in the field. There is a possibility that it has become infilled and is non-functional or that peat cutting has encroached.

Drains bF are a series of mainly old drains along the WNW of the site which are or have been associated with peat cutting and have resulted in an undulating landscape at the bog edge (PM17:8). Peat cutting at the edge of the bog has reduced the length of some of these drains. The larger drains seem to denote turbary plots and are marked on the 6" sheet. The drains are visible on the 1970s aerial photograph but are now shorter due to peat cutting. All the drains have flow - some to the W and some to NNW and there are erosion channels with *R. alba* associated with them particularly at the heads of the drains. Peat cutting has been carried out along some of them especially along Drains bF1, bF3, bF7 and bF9 and there is a lot of active peat cutting still on-going along the edge. The facebank varies from 1-3m in height along this edge except in the vicinity of Drain bF9 and in an area near it where *Molinia* is encroaching on to the high bog. Here the facebank is shallow. The topography of the high bog all along this edge undulates. This is probably as a result of drainage and the peat cutting.

Drain bG runs E/W at the SW of the site and marks the present edge of the bog. An area of old peat cutting lies immediately to the S of it. There are some pits along this drain with regenerating *Sphagnum* species. The facebank is up to 1m tall in this area.

Drains bH are two drains which run NE/SW from the N side of Flush Y to the SW. They are old and infilled with *Calluna* and *S. papillosum* and are thus non-functional. They are shown on the 1910 6" sheet of the site as turbary plot markers.

Drain bJ is along the SW of the NE lobe and may be an extension of Flush Y. It is lined with a narrow band of *Molinia*. The drain is about 0.4m wide with significant water flow to the SE along part of its length. It veers to the SW at the edge of the forestry.

Drain bK at the SW of the NE lobe is three sectioned. All sections are old and have a high water table. There are some patches of *S. cuspidatum*. The longest section of the drain is parallel to the bog edge. There is flow off the bog into the forestry along the two shorter sections and there is a patch of *Molinia* at one of the outfalls.

Drain/Track bL runs E/W from the eastern edge of the bog and joins up with the central road (Drain/track bA). It consists of a gravel track colonised by *Molinia* with *Ulex* and *Salix* and a number of calcicole species. The drains on either side of the road flow towards the W at their western ends and to the E at their eastern end. They are infilled with *Sphagnum* in places. At the E edge of the bog a N/S deep drain (4m) has been cut through the track down to the underlying till (EC 143 µS/cm). The bL drains flow into this which then flows rapidly to the S.

5.2.2 Bog Margin Hydrology (See Drains and Hydrochemistry Map)
The Shiven River lies close to the S and W edges of this bog.

South East
There are old hopper-cutting faces with 2-3m wide face drains and a hint of silty till at drains mA. The drains in the cut-away are 0.5m wide and 1m deep, some move water to the faces. Generally the cut-away is wet and regenerating. *Typha* occur at some in the faces here. Water moves south from drains mA to the main Shiven River tributary.

North East
There are new drains as marked in the cut-away which are 1m wide and direct water NE to the main stream east of the bog. There is intensive hopper-cutting with 2m faces and some slumping. The main collector drain mC, is 2.75m wide and 1.5m deep. There is some *Typha* near bD.

North
This part of the bog has older faces 1-1.75m high with 0.5m faee drains/pools. There has been burning. The peat is immediately adjacent to agricultural fields.

North West
There are new hopper-cutting faces here 2-3m high. The cut-away drains mF, are 1m deep and 1.5m wide in silty till. The faces at the very western tip consist of old hand-cut turf banks with some localised hopper-cutting. Newly deepened drains in cut-away move water west to main stream. Some of the drains are 3m deep with till at the bottom.

South West
There are old hand-cut faces along this entire side. Many turf banks made walk-about hazardous. Deep pockets of water between the banks. Important flush 2m deep, 1m wide. The cut-away is poached in parts.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map)
Water flowing from the bog and the adjacent inorganic subsoil was sampled on the 8-9-94. There had been several heavy rain spells over these days and the previous days. Water flowing off the bog had low ECs, typically less than 100 µS/cm. These values are similar to that of rainfall reflecting the largely inert nature of the peat. Generally relatively moderate electrical conductivities (µS/cm) were noted in the cut-away drains around the bog margins.

South East
The electrical conductivities to the south in the cut-away were 70-180µS/cm.

North East
The ECs are 68-150µS/cm in this area in the cut-away drains.

North
The ECs are 82-174µS/cm in this part of the bog margin.

North West
The ECs here are ~76µS/cm. The drains at the westerly tip have ECs in excess of 200µS/cm.

South West
The old hand-cut faces have electrical conductivities of < 80µS/cm.

5.3.2 Laboratory Hydrochemistry
No samples were taken for analysis at the Coillte laboratory.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
Clooncullaun bog lies in a groundwater recharge zone and is situated at the side of a drumlin filled valley.

Groundwater flow is thought to mirror topography, recharging in the upland area to the north and flowing south to the Shiven River.

Only a low proportion of rainfall is thought to recharge to groundwater since there are high levels of runoff from the widespread clay tills. There are several streams and rivers in the area.

Bog Regime
This bog has a high density of marginal drains and there is hopper cutting in the NE and NW where peat is thickest. There is artificial groundwater discharge in the N, W and E (cut-aways). ECs are often >240 µS/cm.

Inter-relationship
Only some of the cut-away drains at Clooncullaun bog intercept the groundwater-table since EC values were relatively low. Subsoils are moderate permeability (k). Generally ECs averaged 100µS/cm, indicating that the cut-away drains recharge local groundwater.

The main part of this bog developed in the N in a basin and a thin finger lobe formed in the S, between two drumlin ridges. All sides of the bog have been cut-away and so lagg zone potential is zero.

6. VEGETATION

6.1 VEGETATION SUMMARY

This is an intermediate raised bog which has characteristics of both. The bog is soft and wet throughout (except to the SE) though the *Sphagnum* cover does not exceed 20% except in a small pool area where it reaches a cover of 40%. The central and marginal vegetation communities are dominated by *Narthecium* and *C. panicea*. Pools are seen in complex 6/3/2+P to the NE of the NE lobe. *Andromeda* was seen throughout the site and *S. magellanicum* and *S. imbricatum* occur to the N in complex 6/3/2. *S. magellanicum* was also seen in complex 3/2++CL just NE of the central track. *Racomitrium*, a more western species, is seen throughout the site. *Pleurozia purpurea* was seen along the SW edge of the NE lobe where there is rising ground beyond the bog and the facebanks are very low. This area may in fact support blanket peat. A recent burning event has taken place to the NNE of the site but has been more or less confined to the cut-away area.

There are patches of *Myrica* along the line of the old Drain bB.

Three flushes are seen on the bog and these usually consist of a series of swallow-holes with *Pteridium* dominated vegetation surrounding them. *Myrica* on the high bog near the flushes is probably associated with lateral water movement.

There are two tracks near the S edge on this bog which, due to associated drainage, have resulted in increases in slopes. Non-ombrotrophic vegetation is seen along them.

Molinia is encroaching all along the SW edge of the NE lobe and in an area SW of Drain bF9. *Rubus* and *Pteridium* are encroaching to the NE of the site in the vicinity of Drain bD. There are two locations of mesotrophic vegtation on the high bog and they are visible on the 1970s aerial photograph. One to the SW of Drain bF9 supports a clump of *J. effusus* with *Potentilla erecta, P. anserina, Ranunculus repens, R. acris, Rumex, Taraxacum, Urtica, Stellaria media, Dactylorhiza maculata* and *Luzula*. The facebank surrounding it is 1.5-2m tall. The other, to the NW of the site, has recently been burnt and supports *P. erecta, J. effusus, Hypochaeris, Rumex, Dryopteris* and *Polytrichum commune*.

The areas of old peat cutting around the site are generally dominated by *J. effusus* with bands of *Ulex* or *Pteridium* or both though there are also areas dominated by *Molinia* (SW of NE lobe PM17:9-10), areas dominated by *Calluna* (S of NW lobe and a patch to the SW of the NE lobe) and others by regenerating peat - near Slope 4 to the NE and near Drain bF8 to the W. The old turf banks are dominated by tall *Calluna, Pteridium* and *Ulex. Betula* and *Salix* scrub occur throughout the cut-away. *Typha* and *Phragmites* occur in isolated areas in the cut-away. In one area closely associated with Slope 5 to the NE of the site there is a clump of *Typha* where the EC is 110 µS/cm. Other species seen with it include *Caltha palustris, Potamogeton polygonifolius, Rubus, Salix, Molinia J. bulbosus* and *E. angustifolium. Typha* was also seen in two separate areas of the cut-away to the W of the site and at the mid-section of the N edge (EC 158 µS/cm). *Phragmites* was seen growing in

two drains in the cut-away to the NE. The facebanks in this vicinity are up to 4m tall and the facebank drains are probably on till. The older peat cutting areas to the S of the NW lobe are dominated by very tall *Calluna* with pits of regenerating peat. In some of these drains *C. rostrata, Aulacomnium, Potentilla palustris, Salix* and *Succisa* were recorded and the EC varied from 69-85 µS/cm. The regenerating peat areas are dominated by *E. vaginatum, Calluna Narthecium* and *Sphagna* and are very wet. To the SE of the NE lobe there are some pines in the cut-away. A field has been reclaimed and there is a deep marginal drain between it and the bog.

There are two forestry plantations - to the SW of the NE lobe and to the SE of the site.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

This extends as a narrow band around much of the site. It is absent from some areas of active peat cutting and from the SW of the NE lobe where the facebanks are very low and there is rising ground beyond the bog. Where the complex is seen the *Calluna* is up to 50cm tall and there is often much bare peat, erosion channels and slumping associated with past peat cutting. *Pteridium* and *Rubus* are encroaching into this complex immediately N of Drain bD. To the SE of the site S of Drain/track bL there is up to 60% *Cladonia portentosa* in the complex, the *Calluna* is much taller and the terrain very uneven.

Complex 2 + *Molinia*

This covers a small area along the SW edge of the NE lobe. It is poached and there is much bare peat and erosion channels. The facebanks are very low and there is rising ground beyond the bog. There is much *Molinia* and *Potentilla erecta* in the complex (PM17:9-10). *Pleurozia purpurea* was also seen.

Complex 2/3

There are at least three different examples of this complex around most of the SE of the site. They are dominated by *Trichophorum* (35%) and *Carex panicea* (15%). Firstly there is an area where there is little (10-15%) or no *Cladonia portentosa* cover; an area where *Cladonia* cover is higher (up to 55%) and is indicated by +Cl on the vegetation map and there is also an area where the *Cladonia portentosa* cover reaches 95% (2/3 ++ Cl on the vegetation map)

Complex 2/3 with little *Cladonia* is seen at the extreme SSE, SE and the SW edge of the NE lobe. The surface here is very uneven and there are extensive deep erosion channels at the extreme SSE and SE of the site where the bog slopes towards the river. Where this complex occurs to the SW edge in association with slope 16 the area is poached, there is much bare peat, erosion channels, surface water pools and patches of *Molinia. R. alba* is abundant in the erosion channels. The facebanks are less than 0.5m and there is rising ground away from the bog. *Pleurozia purpurea* and *Huperzia selago* were seen in the poached area.

The sections with the higher *Cladonia* cover have obviously not been burnt for some time and the *Calluna* cover is 25% (30-40cm tall). Despite this the bog surface is very hard and uneven, particularly in the 2/3+*Cladonia* area (PM17:5,6+11). Here deep erosion channels, colonised by *Narthecium* and *R. alba* occur. At the SE of the site these erosion channels are aligned N/S and are inter-connected, thus forming a network of surface water run-off carrying points (PL16:30 and 31). The erosion channels are more pronounced on the areas with greater slopes. *Dactylorhiza maculata* was seen in abundance in this complex just N of Flush Z, where it crosses the central road.

The total *Sphagnum* cover is approximately 10% in the +Cl areas, consisting mainly of well developed *S. capillifolium* hummocks which peep up through the lichen cover.

Complex 2/3++*Cl*, seen to the W of the central road, has a much more uniform structure with fewer erosion channels. *Eriophorum angustifolium* is scattered throughout and the bog surface is quite soft in places.

Complex 2/3+ *Myrica* (My)
This is seen at the very SE of the site on the lobe which extends southwards to the river. It is similar to Complex 2/3+ Cl with many erosion channels but it has been more recently burnt and there is practically no *Cladonia* cover. *Myrica* is scattered over the whole area. Parts of this section of the bog were fenced off in the past and there is evidence of cattle poaching. *Molinia* encroaches onto the W side of the bog in this complex. There is abundant tall *Calluna* throughout.

Complex 2/3/6
This is the marginal complex which is seen around the edges of most of the site and to the W of the S end of the central road. It is generally a very narrow band except in the vicinity of Drain bJ at the SW edge of the NE lobe. It consists of 40% *Trichophorum*, 30% *C. panicea* and 10% *Narthecium*. The *Calluna* cover is 15% and it is up to 40cm tall. There is up to 15% bare peat and erosion channels in places with some *Campylopus introflexus*. *R. alba* cover is 5%. There is a very low *Sphagnum* cover and this is mostly *S. capillifolium* and *S. papillosum*. *Racomitrium* was also recorded.

On the W side of the NW Lobe there are many small algal pools in the complex and *Huperzia selago* was noted.

Molinia is encroaching at the SW edge of the NE lobe.

Complex 3
Two small areas of this complex are seen along the W edge of the site in association with Drain bF2 and bF3 and S of bF9. The complex may have suffered burning damage in the not too distant past. The *C. panicea* cover is up to 60% and there is some short *Calluna* and *E. angustifolium*.

Complex 3RB
This is a small area to the NNW of the site which has recently been burnt. Active peat cutting is carried out around the area. There is up to 70% short *C. panicea*.

Complex 4
This is a very small patch to the NE of the NE lobe associated with sloping terrain (Slope 5) and peat cutting. There is much bare peat and up to 60% *R. alba*. Water is flowing off the bog.

Complex 3/2
This is a marginal complex dominated by the same species as in Complex 2/3 but the dominance is reversed, so that *Carex panicea* is more abundant. *Narthecium* cover is approximately 10%. The structure is also more uniform as the erosion channels are smaller. This is probably because of the more gradual slopes seen where this complex occurs. It is seen to the N end of the central road.

3/2++*Cl* indicates areas where the *Cladonia portentosa* cover is around 80% (PL16:26). The *Sphagnum* cover is higher here and the surface is a little softer. *Andromeda* is common and *Racomitrium* was also noted. Some hummocks (30-40cm) occur which are colonised by species such as *Dryopteris dilatata, Dicranum scoparium, Pleurozium schreberi* and *Polytrichum alpestre, Leucobryum, Andromeda, Hypnum* and tall *Calluna*. Some patches with a high cover *of E. angustifolium* occur.

3/2+*Cl* is a small area in the vicinity of Drain bK at the SW edge of the NE lobe where the *Cladonia* cover is 15-20%. The complex is associated with slope 15 and there is much bare peat and erosion channels. *Molinia* is encroaching along the edge of the complex. *Huperzia* was seen.

Complex 3/6/2
This is a very small area seen on the north western slope into the N end of Flush Y. *Carex panicea* cover increase and the bog surface is hard. Patches of *Molinia* are seen. This may occur due to enhanced aeration caused by the water flow into the flush.

Sub-Marginal Complexes
Complex 6/3/2
This is the main sub-marginal complex at this site and in some areas it extends very close to the edge (PM17:7 at the NNE edge). *Narthecium* flats (35%), *Carex panicea* (20%) and *Trichophorum* (15%) are important components of the communities of this complex. Algal hollows also occur (5%) with *Racomitrium* and *Pleurozia purpurea* commonly seen. *R. alba* occurs in some hollows. The *Sphagnum* cover is low (10%), mainly *S. papillosum*. However the surface is quite soft. *S. magellanicum* and *S. imbricatum* were seen to the NNW of the site. There is only a very low *Cladonia* cover, which suggests a more recent fire occurrence than at the S of the site. Northwards the *Cladonia* cover reaches 10% at times and there are some scattered tear pools which are mainly algal. In one area at the NE edge between Drain bB and bC where active peat cutting is on-going this complex extends to the NNE edge. Recent cracking and slumping (Slope 6) were noted and *Huperzia* was seen. There is a patch with *E. angustifolium* in it in the vicinity of Drain bF3.

6/3/2+ *Calluna* (CV)
This corresponds to a section of Complex 6/3/2 where the *Calluna* cover is high and the bushes are tall (30-40cm) with *Cladonia portentosa* under the bushes. The *Calluna* just to the S of this area is only 10-15cm tall. This may be a relict pattern of a fire event.

Complex 6/3/2+ Algal Pools (AP)
This is seen on the central section of the NW Lobe and to the W of the central road (where *S. fuscum* was seen and where the pools are aligned N/S, parallel to the road). *Narthecium* and *Carex panicea* are co-dominant, that is *Carex panicea* occurs more frequently than in Complex 6/3/2. Small algal pools are common (10 -20%) and often support *Menyanthes* and very occasionally *S. cuspidatum*. The micro-topography is otherwise very uniform with no tall hummocks. The *Sphagnum* cover is low/moderate, varying between 10 and 20% but the surface is soft and wet in places.

The higher frequency of algal pools occurs towards the W on the NW Lobe. This complex occurs very close to the bog edge on the S side of the NW lobe. *Campylopus atrovirens*, *R. fusca* and *Huperzia* were seen in this area.

Sub-Central Complex
Complex 6/3/2+ Pools (P)
This is similar to the above complex with *Narthecium* (40%), *Carex panicea* (5-10%) and *Trichophorum* (10%) dominating with the addition of small pools 20%. These shallow pools may be tear pools as many are aligned N/S parallel to the bog edge and at right angles to the slope. They are also inter-connecting in places (PL16:27). Most contain *S. cuspidatum, Menyanthes, Drosera anglica* and *R. alba* with *S. auriculatum* in some. *S. papillosum* is seen around the pool edges. The total *Sphagnum* cover ranges from 30-40% (mostly *S. papillosum* and *S. capillifolium* with bits of *S. fuscum* and *S. imbricatum*) and the bog surface is very wet and soft.

Some tall hummocks occur which are colonised by species such as *Pteridium, Calluna* (with epiphytic lichens), *Potentilla erecta, Vaccinium myrtillus, Pleurozium schreberi, Hylocomium splendens* and *Dicranum scoparium*. The tops of these are degraded and a fire event is suggest by the presence of *Campylopus introflexus*.

The complex occurs on the flattest part of the bog, the area which corresponds to the bog plateau and covers approximately 20ha. It gradually grades into Complex 6/3/2 and the boundaries between the two complexes are a little obscure.

6.2.2 Flushes

Flush Z is located to the mid S of the NE lobe very close to the central track. It is made up of a band of swallow-holes and a subterranean stream surrounded by *Pteridium* and *Molinia* with *Salix* at its S end. Other species seen include *Potentilla erecta, Molinia, J. effusus, V. myrtillus, Agrostis* and *Dryopteris*. To the W is the track with tall *Calluna, Ulex* and *Pteridium* along it. The flush also extends to the west side of the road where there is a patch of vegetation dominated by *Molinia* with *Pteridium, Luzula* and *Potentilla erecta*. The latter spreads out into the surrounding vegetation. *Dactylorhiza maculata* is seen in Complex 2/3+ *Cladonia* to the N of this section of the flush. The whole area around this is very soft and wet.

Flush Y consists of a line of swallow holes running NE/SW at the NW of the bog. It is located in a depression (see slopes 12, 13 and 14) which leads to the western bog edge. The swallow holes are surrounded by *Molinia* and tall *Calluna* (1m) with some *Juncus effusus*. Patches of *Myrica* are seen to the NE of the head of the flush and *Molinia* is seen on the slopes into the feature (PL16:28 to the NE along the flush). The water from the underground stream, which the swallow holes mark, flows into a drain which runs along the W edge of the bog.

Flush X is a small feature at the NW end of the road/Track/Drain bA which runs up the centre of the bog. It incorporates a *Molinia* and *Pteridium* dominated swallow hole with patches of *Myrica* on its northern side. A drain, with rapid water flow, leads from the swallow hole into Drain bA2 along the road edge.

7. BOG TYPE

This bog has been classified as a Ridge River B bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes (See Slopes Map)

A number of slopes were estimated in the field and are described below. Their positions are shown on the Slopes Map.

Slope 1 — At the SE of the site, N of Drain/ Track bL the slope eastwards into active peat cutting is 0.5m over 30m. There is severe cracking and slumping of the high bog surface in this area. Facebanks here range from 2-3m in height and are down to the underlying till in places.

Slope 2 — At the SE of the site this slope is in a south westerly direction to Flush Z and the central track and is 1m over 75m through Complex 2/3 + *Cladonia*. There is associated cracking and slumping.

Slope 3 — At the S of the site, N of Drain/ Track bL, the slope S towards bL is 2m over 350m through complex 2/3 + *Cladonia*.

Slope 4 — At the E of the site into an area of old cut-away the slope is 1m over 30m. There are bare erosion channels. The area of old peat cutting is dominated by regeneration peat with *Calluna, E. angustifolium* and *J. effusus*.

Slope 5 — Also at the E of the site, but into an area of active peat cutting, the slope is 2m over 50m. The facebank is 2-2.5m tall and there is severe cracking and slumping of the bog surface. The hopper method of extraction is used.

Slope 6 — This slope is at the NE of the site in the vicinity of Drain bC and into an area of active peat cutting. The slope is 1m over 20m with severe slumping and the facebanks are 2-3m tall (PM17:7).

Slope 7 — At the centre of the northern edge of the site the slope into active peat cutting and a 1.5m deep face bank drain, is 0.5m over 20m. Erosion channels are associated with this slope.

Slope 8 At the W of the site into an area of active peat cutting the slope is 2m over 30m with slumping of the bog surface. The facebanks are 1.5-2m tall with Complex 1 along the edge.

Slope 9 This is at the SW of the site in a W direction and is associated with active peat cutting where the facebanks are 3m tall. There is cracking and slumping of the bog surface with bare erosion channels through the facebank complex. The slope is 0.75m over 30m.

Slope 10 At the SW corner of the site in a southerly direction the slope is 0.75m over 30m to an area of old cut-away. The facebanks are 1m tall. There is bare peat and erosion channels associated with this on the high bog.

Slope 11 The slope from the W into the active and old peat cutting area, at the SE side of the NW lobe, is 1m over 75m with some slumping of the bog surface.

Slope 12 From the N into the northern end of Flush Y the slope is 0.5m over 50m.

Slope 13 The slope from the E into the same area is 1m over 100m.

Slope 14 The slope to the SW along Flush Y is 2m over 500m.

Slope 15 This is in the vicinity of Drain bK to the SW of the NE lobe and is 0.5m over 30m to an area of old peat cutting. The facebank is up to 1m tall.

Slope 16 At the SW of the NE lobe into an area of old peat cutting which is grazed the slope is 0.5m over 15m. The facebanks are shallow at less than 0.75m. There is poaching in the area.

Slope 17 At the SE of the NE lobe into an area of active peat cutting where the facebanks are up to 4m tall the slope is 0.75m over 30m.

Slope 18 This is the slope at the NW of the central road to the E into the road. It is 0.5m over 50m.

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

There is active peat cutting - mostly using the hopper method of extraction - around much of the site especially to the E, N and W. Some plots along these edges have older cut-away sections. The SSW of the site is mostly an area of older peat cutting. To the S of the NE lobe the extent of the bog today is less than on the 1970s aerial photograph due to peat cutting. The facebanks around the site vary in height from less than 0.5m at the SW edge of the NE lobe to 4m immediately SE of track bL and SE of Slope 6. Those NNW of Slope 6 are 2-3m tall (PM17:7). Facebanks to the W of the site are generally 2-3m tall (PM17:8). The very low facebanks are in an area where the peat cutting seems to be quite old and where there is adjacent rising mineral soil. To the E of the site both sides of Drain/Track bL there has been extensive drainage associated with both peat cutting and land reclamation. To the N of the track the drain at the bog edge is 2m wide and extends for approximately 150m. The facebanks are 2-3m tall. This drain cuts across the edge of Drain/track bL where it is 4m deep and 0.25m wide at the base. It continues SE through an area of active peat cutting where the facebanks are up to 4m tall. In places the peat cutting and associated drainage has exposed the underlying till. There is severe cracking and slumping of the bog surface associated with this cutting. A field, which was indicated as area of old peat cutting in the 1970s aerial photograph, has been improved for agriculture.

8.2.2 Forestry

There is a plantation of Sitka Spruce and Lodgepole Pine along the SW of the NE lobe. It is new since the 1970s aerial photograph but the trees are quite tall. There is a more recent plantation to the SE of the site S of the river and on another bog.

8.2.3 Fire History

Much of this site has escaped recent burning. In the SE section there are areas with up to 95% *Cladonia* on the high bog and *Calluna* up to 40cm tall. This *Cladonia* cover reduces towards the edges. In the NW section there is some *Cladonia* throughout but this does not rise above 15% suggesting the N portion has a more recent fire history. A very recent event has taken place along the N of the site but this has been confined to the bog edge for the most part. The fire has caused damage in a small section to the NNW of the bog.

8.2.4 Cattle Poaching

Cattle, in the grazed area of old peat cutting to the SW of the NE lobe (PM17:9-10), have access to the site as the area is not fenced off and the facebanks are very low. The vegetation of the high bog is dominated by *Trichophorum* with erosion channels and bare peat. Cattle poaching is also seen at the extreme S of the site where parts of the bog were fenced off in the past.

8.2.5 Dumping

Some dumping was seen in the cut-away areas surrounding this site.

8.2.6 Agricultural Improvements

Field improvement to the SE of Drain/Track bL in an area of old peat cutting very close to the high bog and indicated on the 1970s aerial photograph. The marginal drain has been deepened for this purpose. It reaches the underlying till and there is significant flow to the SE.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. The swallowhole flush at the NW of the site is associated with an internal drainage system.

2. The wettest section of the site is on a plateau area to the N. Considerable drying out has occurred.

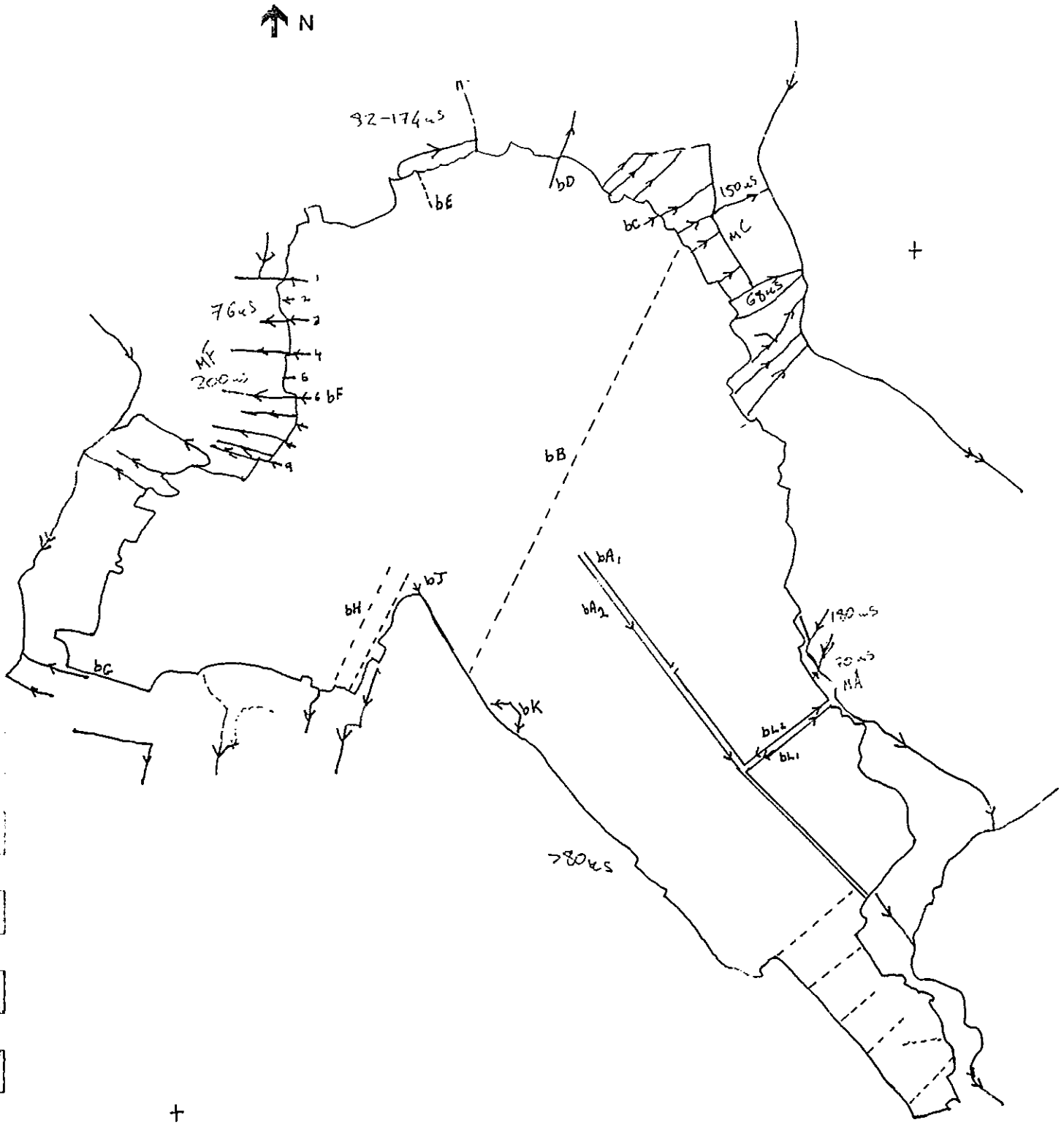
3. At the S section of the site erosion channels are frequent and the bog surface is very hard and uneven. There appears to have been peat slippage in areas.

4. The double drain which runs through the centre of the S section of the site has resulted in considerable drying out of the bog surface.

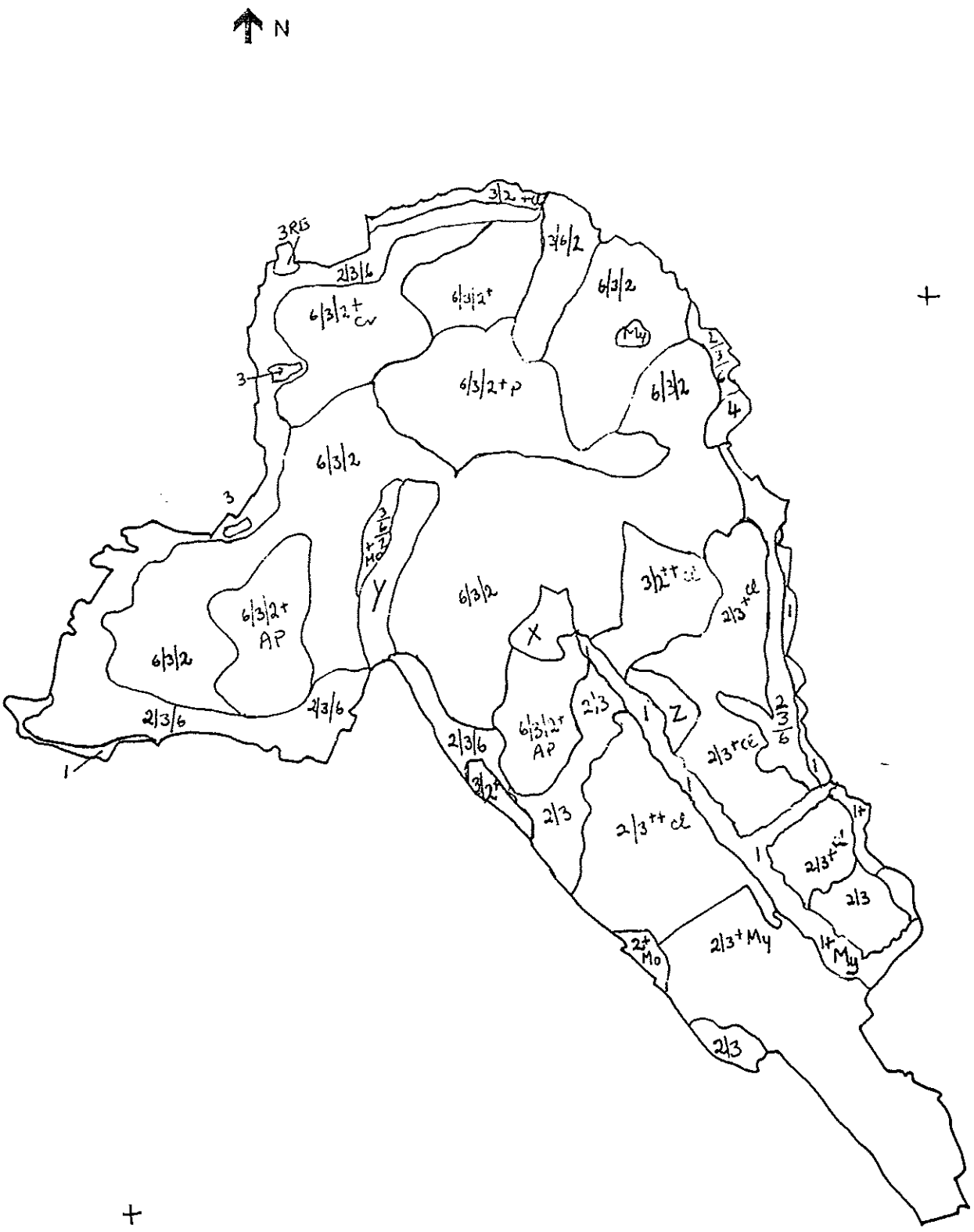
Lara Kelly
Marie Dromey
Malcolm Doak

Raised Bog Restoration Project (1995).

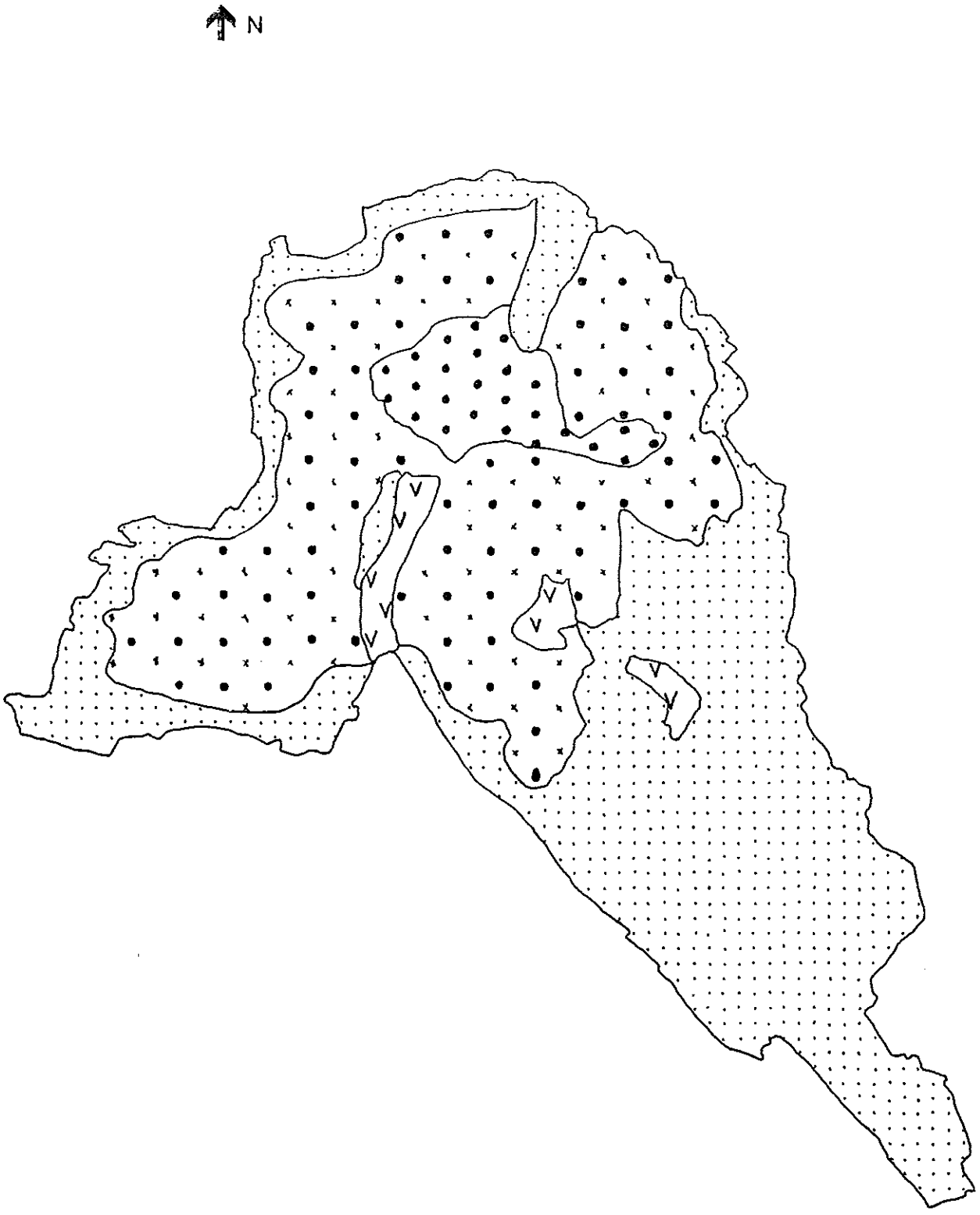
CLOONCULLAUN BOG, CO. GALWAY (245).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994



CLOONCULLAUN BOG, CO. GALWAY (245).
VEGETATION MAP (1:10,560)
1994

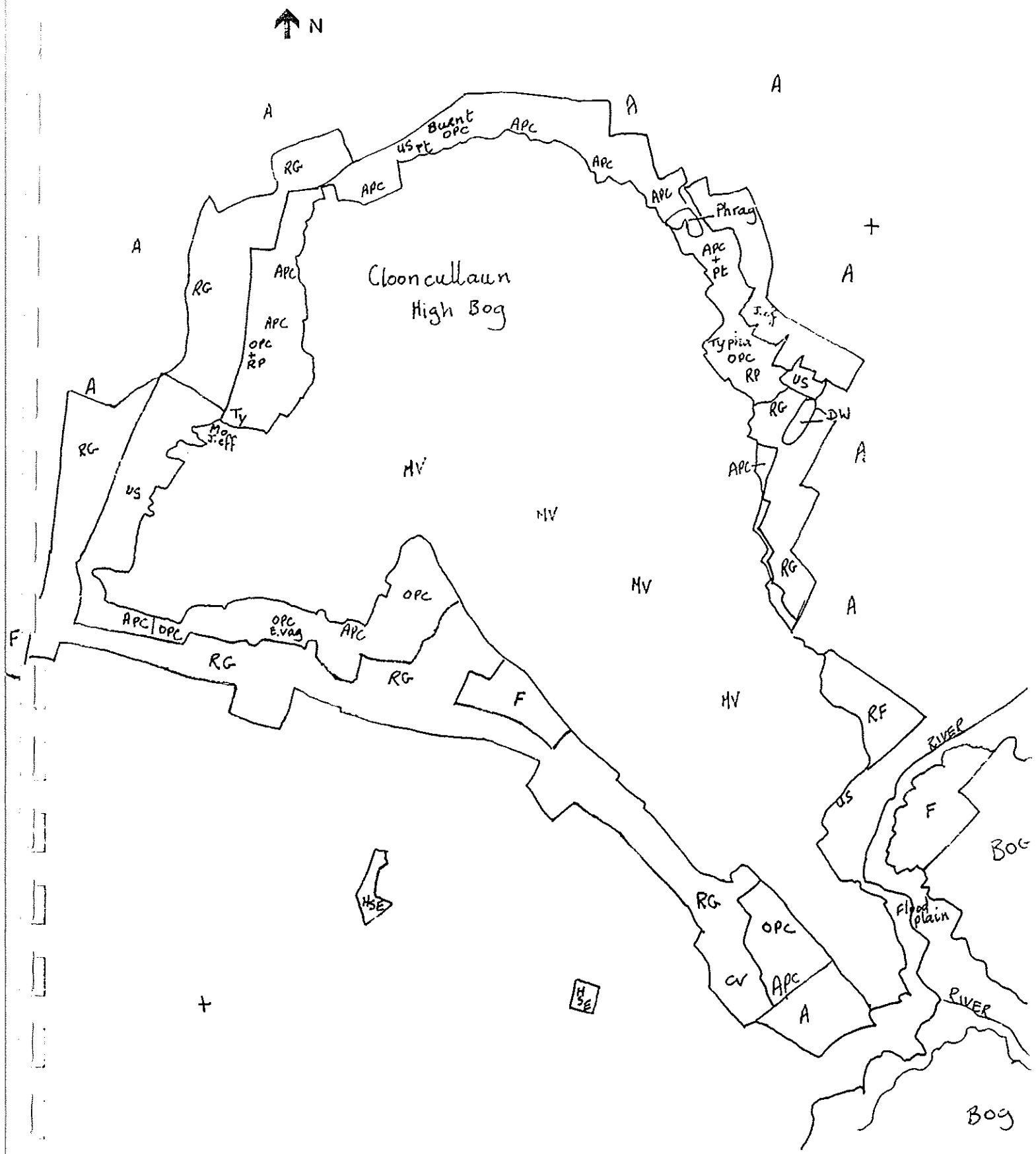


CLOONCULLAUN BOG, CO. GALWAY (245).
ECOTOPE MAP (1:10,560)
1994



CLOONCULLAUN BOG, CO. GALWAY (245).
SLOPES MAP (1:10,560)
1994

CLOONCULLAUN BOG, CO. GALWAY (245).
LANDUSE MAP (1:10,560)
1994



CLOONSHANVILLE, CO. ROSCOMMON

1. SUMMARY OF SITE DETAILS

NHA No.	614		1/2" Sheet:	12
Grid Ref:	M 75 91		6" Sheet:	RN 15
GSI Aerial Photo:	M 655		1:25,000 Sheet:	17/29 SW
Other Photo:	OS 8143 (1993)		Area (ha):	152.0 (High Bog)
NHA Photo:	668:18-23			
Date(s) of Visit:	6/10/1994	(Ecology)		
	6/10/1994	(Geohydrology)		

Townlands Cloonshanville and Sheevannan.

2. INTRODUCTION

2.1 BACKGROUND

This bog was classified as an A site during the National Raised Bog Survey (Douglas and Mooney, 1984). It was described as a very wet site with extensive *Sphagnum* lawns including *S. pulchrum*. In addition a large *Betula* flush in the centre of the site, which exits to a fen area close to the river on the eastern side, added to its conservation value. A small flush was also noted on the SE of the bog where *Schoenus nigricans* was seen.

Cross (1990) included this site in his list of raised bogs selected for inclusion in an NNR network.

Cloonshanville was also visited by the NHA survey team (1993) who found it still to be very wet with a good *Sphagnum* cover.

2.2 LOCATION AND ACCESS

Cloonshanville is located approximately 0.5km to the east of Frenchpark, Co. Roscommon. The River Breedoge runs just to the east of the site and the road between Frenchpark and Brackloon crossroads runs by the south. The site may be accessed from this road.

3. METEOROLOGY

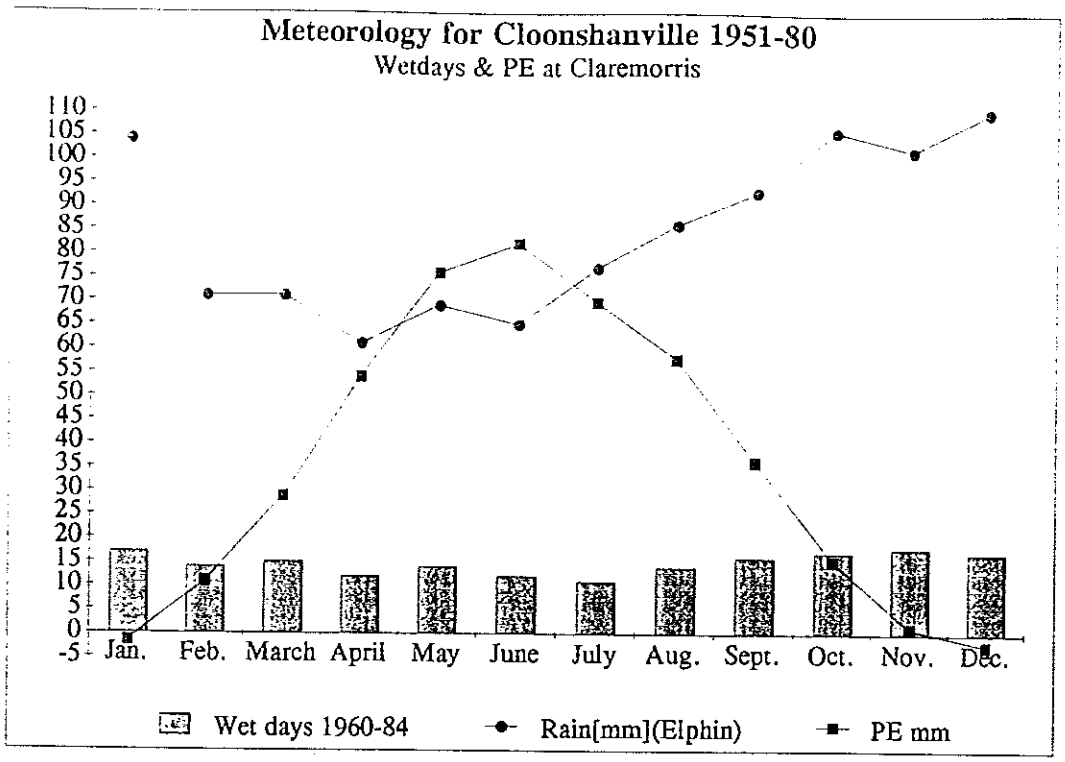
No meteorological measurements have been made on Cloonshanville bog. Rainfall data from Elphin rainfall station for the years 1951-80 indicate that the area receives an average 1014mm of precipitation annually (Fig. 12).

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that the year round actual evapotranspiration (AE) from Cloonshanville Bog is greater than PE at Claremorris, site of the nearest synoptic station which had an average PE of 428.1mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Cloonshanville would therefore be greater than 428.1mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 586mm/yr.

Figure 12:



Meteorological data for Cloonshanville Bog (1951-1981) are summarised below:

Rainfall (P)	1014mm/yr
Actual Evapotranspiration, (AE)	>428.1mm/yr
Potential recharge, (PR)	<586mm/yr

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

This bog is relatively flat and has a flush running south east from its centre. The bog lies in a shallow basin which slopes east to the Breedoge River.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

Cloonshanville is situated alongside the Breedoge River and its east side was once the site of a meander/ox bow lake, which has since disappeared due to drainage. High ground lies to the west of the site where Bellanagare bog is situated.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Smith, show that the area is probably underlain by cherty argillaceous bioclastic Carboniferous limestones (known as ABL). Yellow sandstone lies to the south and south-east of the bog.

The ABL fossiliferous limestones generally have a low permeability and are classed as a poor aquifer.

6.2.1 Complexes

Marginal Complexes

Complex 1

There is a narrow facebank complex dominated by *Calluna vulgaris* around most of the site. It is not found where peat cutting is on-going, for example, where the road/track leads on to the bog at the south of the west arm and at the north of the west arm in the vicinity of the steep vertical excavations.

Complex 3

This *Carex panicea* dominated marginal vegetation complex corresponds to an area on the southern side which was burnt and to disturbed areas on the other slopes where it is found. The disturbance is probably caused by the active peat cutting and the deep vertical edges of the bog. Burning is evidenced by the presence of *Campylopus introflexus* and *Cladonia floerkeana* and much bare peat. *Sphagnum* cover is low and there is no acrotelm layer. Algal pools occur with 15-20% *Rhynchospora alba* cover around the edges with much dead *Sphagnum cuspidatum* present in them. Small amounts of *Leucobryum glaucum* were found on the west arm of the site. On the approach to Flush X from the south, this complex is found on a ridge. Here the *Calluna* is quite tall (20-30cm) and there are *Cladonia* species present including *C. subcervicornis* ssp. *verticillata*. It seems that this area has escaped burning in the recent past. *Cladonia glauca* was also found here.

Complex 3/2

The vegetation of this complex is broadly similar to that of Complex 3 except that in addition there is a high occurrence of *Trichophorum cespitosum*. There is an increase in both the number of algal pools and *Rhynchospora fusca*. Where this complex occurs at the northern edge of the west arm there is a steep slope of approximately 70cm over 40m. There is active peat cutting with a vertical drop of 3m at the edge of the bog. (PL4:19 looking down this slope). There is slumping and cracking of the peat near this edge of the bog. There is also erosion at the north east of the site where this complex is found. There is a variation of this complex found along the southern edge of the west arm. Here, there is much *Erica tetralix* present. At the southern tip of the south end of the site *Narthecium* (Complex 3/2/6) and *Rhynchospora alba* (Complex 3/2/4) become frequent. The area is extremely dry with cracks, slumping and erosion evident.

Complex 4

This complex is dominated by *Rhynchospora alba* and is found on steep slopes at the western end of the west arm, the north east of the site and at the south west of the southern end of the site. Active peat cutting is on-going at the margins beside these areas. There are many algal pools, bare peat and erosion channels present. Indications of a history of burning are the presence of *Campylopus introflexus* and *Cladonia floerkeana* (PL4:22 at the west of the left arm). There is no acrotelm layer. Complexes 3 and 6 - the latter is dominated by *Narthecium* - are found in association with it.

Complex 3/4

This vegetation complex is found in three areas; one to the very south west of the west arm, another at the mid-east edge and the other at the southern end of the south of the site. It contains vegetation communities similar to Complexes 3 and 4 but as one walks across it there are patches dominated alternatively by *Carex panicea* or *Rhynchospora alba*. The areas of this vegetation complex differ from each other in that the more southerly site, which was burnt more recently, supports *Huperzia selago* near the facebank and very little *Cladonia* throughout. At the easterly location there is slumping and severe cracking on a very steep slope to the SSE. There is a drain at the edge (EC 190 µS/cm) with *Typha latifolia* growing. At the more westerly location, which is bounded on the south side by a vertical facebank approximately 8m deep (PL4: 23 and PM5), there is greater *Cladonia* cover and small patches of *Racomitrium lanuginosum* and *Myrica gale*.

Complex 3/6

This is found west of flush Y on the west arm of the site and is surrounded by the vegetation of Complexes 3 and 6. There is virtually no acrotelm layer and the *Sphagnum* cover is low. There is high cover of *Cladonia* species including *C. furcata*, *C. portentosa* and *C. uncialis*.

Drain bH is an old drain which runs NNE/SSW through the centre of the SE Lobe. In the central section it is infilled with *Calliergon cuspidatum, Menyanthes* and *Carex rostrata* with *Molinia, Anthoxanthum, Empetrum, Angelica* and some *Pteridium* (EC 80 µS/cm). Tall *Calluna* grows along the edges and *Schoenus* was seen close by. This enriched area is probably associated with Flush X which runs nearby. There is flow off the bog at the SW end of the drain. Flow was not detected at the NE end.

Drains bJ are two new, short, deep drains which have been dug this year (1994). They are 0.75m deep by 0.2m wide with significant flow off the bog to the SW. They are associated with active peat cutting where the bog adjoins the main road.

Drain Complex bK is a series of short drains, perpendicular to the bog edge with the main road. They have been dug since the 1970s and are 0.2m wide by 0.25m deep and are associated with active peat cutting. They all flow off the bog to the SW.

5.2.2 Bog Margin Hydrology with Face Bank Details (See Drains and Hydrochemistry Map)

South

To the west of the forestry there are no faces, there is only a slight slope up to the high bog with a stagnant drain 1.5m wide. Going west, several recent drains (mA1) up to 1.75m deep have been dug into the near edge of bog, where water is a maximum 5cm in depth. Similarly deepened drains occur at right angles in the cut-away which move water south to the road. At mA3 there is a 20m section of hopper cutting where the face drain is 2m high and water depth is 10cm.

West

Hopper cutting starts at the very south western corner at drain bA, and occurs along the west side of the bog for 250m. At bA, the faces are 2m high with a 1.5m wide face drain. A large new 2.5m wide by 2m deep drain (mA4) moves water from this area to the cut-away. Moving north to bB1, the faces are a maximum of 1.75m high. One long connected face drain (mB) which is > 2m wide drains these faces. There is iron on the water surface of all the cut-away drains from bA to bB1.

The hopper cutting stops at the 250m north, where it meets a minor grass covered peat lobe. The long connected face drain mB, becomes much narrower and forms bB2 since it now drains a section of the high bog. *Phragmites* grows along drain bB2. There are very old cut faces on part of the peat lobe at mB2. *Phragmites* grows all over this peat lobe. Groundwater upwells at mB2, a 3m deep x 3m wide drain, which separates the peat lobe from agricultural land. The water here is 10cm deep. The agricultural land is composed of clayey till where there are rushes. There is quite a varied vegetation on the peat lobe to the east of this drain.

Further north along the west face there are old hopper faces up to 2.5m high at point mD. The face drains here are relatively stagnant. The corresponding cut-away is relatively wet.

North

The cut-away faces along the entire northern side of the bog are relatively old and overgrown with maximum face heights of 1.5m. The face pools are often overgrown with *Sphagnum* and have low ECs. Most drains sited in the cut-away are overgrown. There is a very localised extent of hopper cutting mid-way along the north faces coincident with a minor household dump. At point bF there is a deepened 0.5m x 2m drain draining a grass/rush cut-away. At the very NE corner the cut-away has an area of *Phragmites.*

North East

This part of the bog has very old faces and is site of the main outlet for the old set of double drains draining the main forestry area at bE. The faces here are a maximum of 0.5m high with *Typha* growing in the face pools.

East

Access to the east side of the bog from the north is beside the river. The river is several metres below the level of the bog. 5m high 'walls' composed of dirty gravels separate the bog from the river. Therefore the river is draining a large part of this side of the bog.

Moving south along the bog there is no cut-away, only a gradual change from a grass covered area up slope to the bog. The grass area is very permeable since it is underlain by gravels. There is a large flush at the start of the main track.

Minor Lobe
The track has divided the bog into two. To the NE of the track lies an area of mineral soil, oval like in shape with forestry on its east side. This was once a lake 'Loughanlha', and is probably composed of lake clays.

Industrial cutting occurs along the east side of this minor lobe. The main drain, which forms the easterly boundary has an EC of 179µS/cm.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map)

Water flowing from the bog and the adjacent inorganic subsoil was sampled on the 6th October 1994.

South West
The Electrical Conductivity (EC) at the stagnant drain was 78µS/cm with *Typha*. The deepened drains at mA have ECs in the range of 85-125µS/cm. At mA3 there is an EC of 260µS/cm coincident with the hopper cutting.

West
There is marked groundwater contribution between points bA to bB1. The new deep drain mB, in the cut-away has an EC of 400µS/cm with iron. The face drain at mB has an EC of 387µS/cm with traces of iron. Along drain mB to bB2, the EC is markedly reduced at 72-92µS/cm since it drains the high bog.

Groundwater upwells at the 3m deep x 3m wide drain, mB2, where the EC is 744µS/cm. ECs are around 80µS/cm at the old hopper faces, point mD.

North
The face pools of the old faces have low ECs of 83-122µS/cm. Water moving from the dump had an EC of 210µS/cm.

North East
The old set of double drains have an EC of 100µS/cm. The faces near bE have an EC of 164µS/cm.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
This bog lies in a shallow basin which slopes east to the Breedoge River. The east side was once the site of a meander/ox bow lake, which has since disappeared due to drainage. High ground lies to the west of the site where Bellanagare bog is situated. Cloonshanville lies in a groundwater discharge zone but the water-table has been lowered due to extensive drainage works in the area around Lough Gara.

Bog Regime
There are relatively few drains on the high bog but there are many drains in the cut-away particularly to the south. Generally the ECs were ~150µS/cm in the shallower cut-away drains apart from those in the west where ECs were >300µS/cm in drains that intercepted the regional water-table. Little runoff from the bog is believed to infiltrate to the watertable since subsoils are generally of low permeability at depth.

Inter-relationship of topography hydrology and hydrogeology
The bog lies in a regional discharge zone where drainage has lowered the water-table. This has caused a former lake in the east to dry out. The bog now is dominantly a site for recharge if anything.

6. VEGETATION

6.1 VEGETATION SUMMARY

The main feature of this site is the large flush (11.6ha) which occurs on the centre of the site. This is rich in places with species such as *Potentilla palustris, Lychnis flos-cuculi, Carex rostrata* and *Cardamine*. The main body of the flush is dominated by *Betula* and *Molinia* tussocks.

A high *Cladonia portentosa* cover and tall *Calluna* seen over much of the site suggests that no major burning event has occurred in recent years.

Two very wet areas occur at this site, namely Complex 6/10 (*Sphagnum* cover 55%) and 9/7/35 + *Cladonia* (25% pools). However the combined coverage of these two complexes is only 1.4ha of the site. On the other hand Complex 9/7/6 +*Cladonia* covers a large section of the bog with a moderate *Sphagnum* cover of 30% and a wet soft surface. Much of the bog surface is wet, soft and difficult to walk through.

Eriophorum vaginatum is abundant over most of the bog. This may be due either to the influence of the soak or to the fact that burning has not occurred for some time.

Both western and eastern indicator species are present as *Racomitrium, Carex panicea, Campylopus atrovirens, Andromeda* and *S. magellanicum* were seen frequently. *S. imbricatum* and *S. fuscum* were also recorded in notable amounts.

Within the *Pinus contorta* plantation to the N on the high bog, *Calluna* dominates the shrub layer (1.2m tall) with *Hylocomium* and *Pleurozium schreberi* dominating the bryophyte layer.

Scattered patches of *Myrica* are seen at the W and N edge and along Drain bC, *Molinia* and meadow species with *Ulex* occur along the mid W edge and *Phragmites* is seen at the W edge and to the N and E of the SE lobe. Much of the bog is surrounded by areas of old cut-away. To a large extent the cut-aways at the SW and W are dominated by *Juncus* though there are areas of regenerating peat which are quite close to the bog and areas where more mesotrophic species such as *Agrostis, Angelica, Filipendula, Ranunculus acris* and *R. repens* are growing. New deep drains (up to 1.5m) have been excavated, possibly with the intention of field drainage. In this area there are also some small *Betula* clumps in old drains close to the bog.

Further N along the W of the site *Betula*, Lodgepole Pine and *Phragmites* are seen in areas of old cut-away with *J. effusus* and *Molinia* dominating in the more open areas. There is some regenerating peat in the NW corner with abundant *Calluna*. *Typha, Angelica, Rubus, Valerian* and *Betula* were seen in some of the old drains. Along the N of the site there is regenerating peat with a lot of *Calluna* in the more western sections and *Myrica* in the eastern. There is a large patch of *Phragmites* in an area of old peat cutting to the NE of the site. *Typha, Cardamine, Angelica, Hydrocotyle* and *Lemna* are seen in the facebank drain in this area. (EC 108-163 µS/cm) Along the ENE of the main body of the site there is peat regeneration with some areas dominated by *Calluna* and others by *J. effusus* and *Molinia*. Some of the old drains support mesotrophic species such as *Typha*. Further S along the E of the main body of the bog the River Breedoge forms the boundary and there is riverside vegetation present. The bog grades down to this and the vegetation is dominated by *E. angustifolium*. There are some isolated *Salix* trees with areas of regenerating peat further S where there is a wider area between river and bog.

Between the main body of the bog and the SE lobe there is a large area of old cut-away dominated by *Phragmites* with regenerating peat beneath (PM18:22). *Schoenus nigricans* was recorded. On the 1840s 6" sheet a lake is shown on this area (Loughanlba). Further E another lake, Lough Bally, was drained since 1840s and this may have had a draw down effect on Loughanlba. Closer to the bog at the exit of Flush Y the species present suggests the influence of mineral soil. Along the N of the SE lobe there is a *Pinus contorta* forestry plantation which does not appear to be doing very well. Along the SE of the SE lobe there are old drains associated with the track and these are dominated by tall *Calluna*. There is also some active peat cutting. SE of the track there are large areas of another

bog which are being industrially harvested. At the SW of the SE lobe the bog is bounded by the main road and there is further active peat cutting. There are some small cabbage plots along the edge of the bog (PM18:23). The NW of the SE lobe is separated from the main body of the bog by an old track and infilled drains.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

This complex is not seen around the entire site. It occurs along the W edge where the *Calluna* is up to 1m tall and there are patches of *Phragmites*. It is also seen in the NW corner with *Cladonia* cover up to 40%; in the NE corner where *Myrica* is present; to the SE of the main bog where the complex is quite wide and around most of the SE lobe.

Complex 3/6/2 + Tear Pools + *Cladonia* (+TP+Cl)

This complex is seen along the N edge of the bog on sloping ground (Slope 9) and is dominated by *C. panicea* (30%), *Narthecium* hollows (20%) and 15% *Trichophorum* with 40% *Cladonia*. The *Calluna* cover is high (30%) and is 40cm tall. The ground is hard and dry and quite tussocky. *Huperzia* was recorded.

Complex 3/7/9+*Cladonia* (Cl)

This complex is dominated by *C. panicea* with *Calluna* and both *E. angustifolium* and *E. vaginatum*. It is seen at the E of the site both N and S of Drain bC.

Complex 3/9/7 + *Cladonia* (Cl)

This complex is seen at the N of the site and is dominated by *C. panicea* (30%), *E. angustifolium* and *E. vaginatum* (25%), *Calluna* (25% which is 40-45cm high), *Narthecium* (10%) and *Cladonia portentosa* 40%. The ground is hard underfoot. In places the *Trichophorum* cover increases and that of *Eriophorum* reduces. There is a small area within the complex with deep open water tear pools which support *S. papillosum*, and *S. pulchrum* at the edge with some *S. cuspidatum* and *Menyanthes* in the centre. Some run N/S and carry water off the bog.

Complex 6/3/2+Tear Pools + Erosion Channels + *Cladonia* (+TP+ER+Cl)

This complex is seen at the NW of the site and is dominated by *Narthecium* hollows (30%) and *C. panicea* and *Trichophorum* both at 15% - the latter increasing nearer the edge. There are erosion channels and tear pools. There is 35% *Calluna* which is up to 45cm tall and the *Cladonia* cover is 60%. The complex is associated with Slope 6 which is quite steep.

Complex 6 + *Cladonia* (Cl)

This is seen on the SE lobe. It is dominated by *Narthecium* (45-60%) with very little *Calluna* (up to 20% which is < 25cm tall) and *Trichophorum* (25%). The *Sphagnum* cover is poor (< 15%) and the ground hard. There is a small amount of *Cladonia* (5%) and *Racomitrium* was seen. The area may be drying out because as well as being marginal it is also associated with Drain bH. It is also seen at the SW of the site with up to 10% *Cladonia*. There are small amounts of *C. panicea* and *Trichophorum* (both at 5%). *Calluna* (35%) cover is higher here and taller (up to 40cm tall). There is very little *Sphagnum* cover - it consists mainly of *S. subnitens* and *S. tenellum* with a very small amount of *S. fuscum* - and the ground is very hard with some small algal hollows. The complex in this area is associated with Slope 2.

Complex 6 +Tear Pools +*Cladonia* (TP + Cl)
This complex is also in the SE lobe and next to Complex 6 +*Cladonia*. It is similar but with the addition of small tear pools. These are aligned mainly N/S and appear unhealthy. *R. alba* is present in some and the *Trichophorum* cover throughout the complex is reduced.

Complex 7/3/2 + Erosion Channels +*Cladonia* (ER+Cl)
This occurs at the NW corner of the site and is associated with slopes 7 and 8. It is very dry and tussocky with up to 75% *Cladonia* and is dominated by *Calluna* (55%), *C. panicea* (15%) and *Trichophorum* (10%). There are deep erosion channels and parts of these too are clothed in *Cladonia*. In others there are some steep sided pools with *R. alba* and *R. fusca* as well as *S.. auriculatum, S. cuspidatum, S. magellanicum, S. papillosum* and *S. capillifolium* near the edges. *Pleurozia purpurea* was recorded in the complex.

Complex 6/3+*Cladonia* (Cl)
This is seen along the SW edge immediately N of Complex 6 +*Cladonia*. Both are fairly similar except that there is 20% *C. panicea* and less *Cladonia* in this complex. This may suggest burning at some time in the not too distant past. This complex is on steeper ground.

Complex 6/9/7
This is seen close to Drain bH on the SE Lobe. *Narthecium* (40%), *E. angustifolium* (20%), *Calluna* (20% and 15 -20cm tall) and *E. vaginatum* (5%) dominate. The bog surface is not soft in this area.

Complex 7/6
This is seen at the S corner of the site is dominated by *Calluna* and *Narthecium* (up to 40%) and covers a small area. The ground is dry and hard underfoot. There is active peat cutting being carried out along both bog margins. The area is associated with Slope 13.

Complex 9 and Complex 9 + *Myrica* (*My*)
This is an area of bog at the E of the site where attempts may have been made to reclaim it. It is fenced off from the main body of the bog and is dominated by both *E. angustifolium* and *E. vaginatum* with a band of *Myrica* nearer the edge.

Sub-Marginal Complexes
Complex 6/9A/3+ Tear Pools (TP)
This is seen on the SE Lobe. *Narthecium* and *E. angustifolium* dominate with *Carex panicea* and *Calluna* also important. The *Calluna* bushes range from 15-20cm. Small, shallow pools occur (5-10%). A few are *S. cuspidatum* pools with *S. papillosum* and *Campylopus atrovirens* around the edges but most are algal. *R. alba* and *Menyanthes* are seen occasionally and *S. pulchrum* and *S. magellanicum* infill some. The pools may be tears as they are at right angles to the slope. The total *Sphagnum* cover is about 15% and the surface is quite hard between the pools. There is some evidence for past fires such as *Cladonia floerkeana* and short *Calluna*. *S. imbricatum, Leucobryum* and *Racomitrium* were noted.

Complex 6/7/9+*Cladonia* (Cl)
This is seen at the SW of the site. It is dominated by *Narthecium* and *Calluna* (both with 35% cover and the *Calluna* is 40cm tall), with *Eriophorum* cover at 30% - 20% *E. vaginatum* and 10% *E. angustifolium*. There is a 10% *Cladonia* cover. There is little *Sphagnum* cover - up to 15% consisting mainly of *S. capillifolium*. The ground is moderately soft and wet.

Complex 6/7/9+*Cladonia* + Pools (+Cl+P)
This complex is similar to the above with the addition of pools though the slope to the edge is very slight (Slope 3). The pools are 2-3m and most are aligned NW/SE. They are infilled mainly with *S. cuspidatum, S. auriculatum, Drosera* and *Menyanthes* with small amounts of *R. alba*. At the pool edges *S. papillosum, S. pulchrum* and *S. magellanicum* can be seen. Towards the W edge of the complex the pools become unhealthy. The inter-pool area is soft and there are some tall and wide hummocks topped by tall *Calluna, Cladonia, Empetrum, Pleurozium schreberi, S. imbricatum, Dicranum, S. capillifolium, Hypnum* and *V. oxycoccus*. Both *Andromeda* and *Racomitrium* were seen in the complex.

Complex 7/3/9 + *Cladonia*
This complex is seen to the SE of Drain bC between blocks of forestry and is dominated by *Calluna* (50%) which is 20-30cm tall. *C. panicea* (20%). *E. angustifolium* and *E. vaginatum* (15%) and *Cladonia portentosa* (5%). There is 10% *Sphagnum* cover consisting of *S. papillosum, S. capillifolium* and *S. tenellum*. The ground is hard underfoot.

Complex 7/9/3 + *Cladonia* (*Cl*)
This complex is seen between the two blocks of forestry at the E of the site S of Drain bC. It is dominated by 60% *Calluna*, 25% *E. angustifolium* and *E. vaginatum* and 10% *C. panicea*. There is 40% *Cladonia* cover. The ground is soft though the *Sphagnum* cover is about 15%. *S. imbricatum* and *Empetrum* hummocks were seen. This complex grades into Complex 7/9+ *Cladonia* where the *C. panicea* cover peters out.

Complex 7/9+ *Cladonia* (*Cl*)
This complex is seen at the W of this site. It is dominated by tall *Calluna* (up to 70% which is 60cm tall) and *Eriophorum vaginatum*. Tall *S. capillifolium* hummocks and a small amount of *S. imbricatum* and *S. tenellum* were also recorded. Further into the bog the *E. vaginatum* and *Sphagnum* cover increases and the *Calluna* is shorter. *Cladonia* cover is 10-15%. The ground is hard underfoot and difficult to walk through as it is quite tussocky. There are some very small hollows with *S. cuspidatum*. Close to the bog edge there is scattered *Molinia, Myrica* and *Phragmites*. *Myrica* increases further N in the vicinity where Drain bC exits the bog to the W.

There is a very small area of this complex to the E of the site between the forestry blocks where there is less *Calluna* than at the W of the site and it is shorter. There is also more *E. angustifolium* present than at the W of the site.

At the SW of the site in association with the SW arm of Flush Y there are small scattered areas of this complex where the *Cladonia* cover is 30%. There is a high *Sphagnum* cover (50%) mainly of *S. capillifolium*. There is evidence of enrichment and species seen include *Empetrum, Aulacomnium palustre, Pleurozium schreberi, Dicranum, V. oxycoccus* and *P. alpestre*. This is a sub-central section of this complex.

Complex 7/9+*Cladonia*+*Myrica*+*Molinia* (*Cl*+*Mo*+*My*)
Another area of this complex can be seen to the E of the site N and S of the exit of Flush Y and continuing SE. There is an abundance of *Molinia* and *Myrica* and patches of *Phragmites* throughout. The *Calluna* cover is 65% and up to 50cm tall. There is 5% *Cladonia*. The ground is hard underfoot. The area to the N is associated with Slope 10. The complex grades into the old cut-away area dominated by *Phragmites, Molinia* and forestry. Another area of this complex occurs at the NNE of the site where there is an abundance of *Myrica*. The *Calluna* is almost 1m tall in this area and the *Cladonia* cover 60%. There is little *Molinia* here.

Complex 9/7/3
This is similar to Complex 9/7+*Cladonia* but has recently been burnt. It is seen at the E of the site near an unburnt example of the complex. The *Calluna* is short (< 20cm) and there is *C. panicea* throughout (20%). There is no *Cladonia*.

Complex 9/7+ *Cladonia* (Cl)
This complex to the SW of Drain bC has a very high *Cladonia* cover (up to 70%) and *Empetrum* has a 5-10% cover. E. vaginatum and *Calluna* dominate. The surface is soft and there are small amounts of *Narthecium*. Some *Betula* seedlings are encroaching. It is also seen NE of the main flush. Here *Cladonia portentosa* cover is approximately 20%. Close to the flush *E. angustifolium* occurs more frequently and there are some *S. papillosum* lawns/hollows. *Empetrum* is also seen in this area.

Complex 9/7 ++ *Cladonia* (*Cl*)
There is a small area of this complex at the E of the site N of Drain bC and is assoeiated with the forestry and the species list indicates mineralisation. *Cladonia* cover is 40% and there is a high cover of *Calluna* (50cm tall) and both *E. angustifolium* and *E. vaginatum*. The *Sphagnum* cover is 20%

including tall *S. capillifolium* hummocks, *S. fuscum* and *S. imbricatum*. Other species seen include *Empetrum, Pleurozium schreberi, P. alpestre* and, *V. oxycoccus*. The area is quite dry. The complex extends S of the forestry.

Complex 9/7
There is another small patch of this complex S of the forestry plantation on the high bog but the *Cladonia* cover is much lower (< 5%) and the *Calluna* much shorter. The area may have been lightly burnt in the past. *Sphagnum* cover is high but some of the hummocks are degraded. Regeneration is occurring though the ground is not soft. Complex 9/7 is also seen on the SE lobe where the *Cladonia portentosa* cover is only 5%. *E. vaginatum* (55%) and *Calluna* (40% and 35cm tall) dominate. *Empetrum* was also noted.

Sub-Central Complexes
Complex 7/9 + Pools + *Cladonia* (+P+*Cl*++)
This occurs to the N of Drain bC. It is dominated by *Calluna* and *E. vaginatum* with up to 80% *Cladonia* cover. There are occasional *S. papillosum, S. pulchrum* and *S. cuspidatum* pools and also some linear pools with *Narthecium* and *R. alba*. *Menyanthes* is quite frequent. Scattered throughout this area are small hummocks topped by *Empetrum* and *Aulacomnium*. Closer to the W edge of the large forestry plantation on the high bog there are no pools. In addition to the species already mentioned *V. oxycoccus* and *Pleurozium schreberi* were recorded in this area of the complex. There is no drain at this edge of the forestry.

Complex 9/6/7
This complex is seen at the centre of the site to the W of the main flush. It is similar to Complex 9/7 except that *Narthecium* is more important (20%), forming soft wet lawns. *Calluna* cover falls a little and the vegetation is more open with *Sphagnum* lawns. These lawns are composed mainly of *S. papillosum* and *S. pulchrum* with some *S. magellanicum*. *S. imbricatum* is very frequent forming low wide hummocks. *S. fuscum* was also seen frequently. The surface is soft and difficult to walk over. *Cladonia portentosa* cover is approximately 10%. This complex is also seen inter-mingled with patches of *Phragmites* within Flush X on the SE Lobe. The *Sphagnum* cover is moderate and the bog surface is soft.

Complex 9/6/7 + Pools + *Cladonia* (+P+Cl)
This is similar to the above complex with the addition of pools and is seen at the NW corner of the northern forestry plantation. Large lawns/ pools of *S. magellanicum, S. papillosum, S. pulchrum* and *S. auriculatum* occur with some wetter patches with *S. cuspidatum* and *Menyanthes*. These lawns/pools (20% cover) have a N/S orientation and are up to 6 m long and 0.5 -1 m wide. The surface is very wet and quaking and there is a higher cover of *Narthecium* than in the above complex. *Cladonia portentosa* cover is high (20%) on the inter-pool sections.

Complex 9/7/6 + *Cladonia* (Cl)
This complex at this site covers a large area. It is seen at the SE in the vicinity of the forestry plantation, in an area to the W of the site and both NW and NE of Flush Y. At the SE of the site the complex is variable (PM18:15). Close to the SW end of Flush Y the *Cladonia portentosa* cover is 10% and the *Calluna* (30%) is 30-40cm tall. There is a good *Sphagnum* cover (30%) consisting of *S. capillifolium, S. tenellum, S. papillosum, S. fuscum* and *S. imbricatum*. Some of the *S. imbricatum* hummocks are low and wide. The cover of *S. imbricatum* and *S. fuscum* increases to the W in this area. There are some *Sphagnum* lawns and *S. pulchrum* was seen. *Narthecium* cover is low at 5-10%. *E. angustifoliium* occurs in concentrated patches (10%) and there is 30% *E. vaginatum*. There is a more or less uniform structure throughout the complex with 80% of the vegetation lower than 10cm. There is no open water.

To the W in this area of the complex there is a curvilinear feature associated with Slope 1 and which may also be associated with Flush Y. It consists of a few large pools/lawns infilled with *S. cuspidatum, S. auriculatum* and *S. pulchrum* with *S. magellanicum* at the edges (PM18:16-18). Other species include *E. angustifolium, Menyanthes, Drosera* and some *R. alba*. Throughout the W of this area of the complex there are some tall hummocks which may have been used for shooting

purposes. Species seen include *Molinia, Empetrum, Pleurozium schreberi, Hypnum, Aulacomnium, V. oxycoccus* and tall *Calluna.*

Where this complex is close to the forestry at the SW of the site the *Sphagnum* cover is higher and there are tall *S. capillifolium* hummocks. In addition the *Calluna* in this area is up to 50cm tall. These two features may be as a result of fertilizer which may have been associated with the forestry.

Where this complex occurs near the W of the site there is a higher *Eriophorum* cover than to the SW of the site and the *Calluna* is tall (50cm). The ground is softer and wetter and a clump of *Myrica* was recorded.

S of the NW arm of Flush Y the *Cladonia* cover is 15-20% and *Pleurozia purpurea* was seen. At the N of the NW arm *E. angustifolium* and *Narthecium* dominate and there are soft lawns of *S. papillosum* with *E. vaginatum* and *Calluna* in between. Close to the flush some *Calluna* hummocks with *Empetrum* are seen. The *Cladonia* cover is mainly 10-20% but there are patches where it reaches 40%. Some large *Racomitrium* hummocks were seen in this area of the complex.

To the SE of Drain bC and closely associated with a large forestry plantation on the high bog, this complex occurs. It is dominated by *Eriophorum* (up to 60%) and there is 20% *Calluna* which is very short. *Narthecium* at 10% is confined to hollows. The surface is soft and *Sphagnum* cover is moderate (up to 25%) consisting mainly of *S. capillifolium* and *S. tenellum* on hummocks with *S. papillosum* lower down. *S. imbricatum* and *S. fuscum* were also seen. There is some *C. panicea* throughout and the *Cladonia* cover is 10-15%. There are no large hummocks. Further out into the bog the cover of *Cladonia* decreases and the ground becomes harder.

Close to the S arm of Flush Y the *Calluna* is short (35cm) and there is a low *Cladonia portentosa* cover (Complex 9/7/6).

Complex 9/7/6 + Pools + *Cladonia* (+P+*Cl*)
A small area of this complex with the addition of pools occurs to the NE of Flush Y.

Central Complexes
Complex 6/10
This is seen to the WSW of the site and is dominated by *Narthecium* (45%) and total *Sphagnum* cover (55%). The *Sphagnum* consists of *S. papillosum* hummocks and lawns (25%), *S. capillifolium* (10%), *S. imbricatum* hummocks, *S. pulchrum* and *S. magellanicum* each at (5%). Small amounts of *S. cuspidatum* were also seen. *Trichophorum* cover is 10% and there is some *R. alba*. The structure of the complex is quite uniform with 70% less than 10cm high. This consists of the flat lawns of *Narthecium* and *Sphagna*. There are some hummocks mainly of *E. vaginatum* and there is some open water. The ground is soft underfoot. Other species seen in the complex include *Racomitrium, S. fuscum, Andromeda, S. auriculatum* and *C. panicea.*

Complex 9/7/35+*Cladonia* (*Cl*)
This is the wettest complex of the site and is located NW of Drain bC in a depressed area associated with Drain Complex bD. Pool cover is 25% with some open water (5-10%) (PM18:19+20). There is infilling with *S. cuspidatum, S. auriculatum, Drosera, S. pulchrum* and *Menyanthes. Racomitrium* islands were seen (PM18:21). At the pool edges are lawns of *S. papillosum* and *S. pulchrum. Narthecium* and *R. alba* occur in the drier areas around the pools. In the inter-pool areas the *Calluna* is 35cm tall and the *Sphagnum* cover is not very high. This may be attributed to the moderately high cover of *Cladonia* (50%). Where Drain Complex bD runs through this vegetation complex it is infilled with a similar list of species. (PM18: of the complex).

6.2.2 Flushes

Flush Z is a small area of *Phragmites* seen at the NE corner of the southern forestry plantation.

Flush Y (Carricknabraher)

This area is shown as small lakes on the 1840s 6" sheet and noted as Friar's Holes on 1910 6" sheet. Today the flush covers an area of approximately 11.6ha at the centre of this bog and is the most interesting feature of the site. It consists of a main body with channels or linear sections of flushed vegetation to the N, S, SW and NW. It appears that the central flow of water through the flush is to the SSE towards the river.

The SW arm is the richest area (EC 81 µS/cm, pushed into surface water which was probably diluted by precipitation) and looks like a crack or channel through which mesotrophic water percolates from below. The edges are hard and are dominated by tall *Calluna* and *Myrica* while the centre of the feature is quaking. Species recorded in this area included the following: *Carex rostrata, Potentilla palustris, P. erecta, Menyanthes, Juncus effusus, Salix, Dactylorhiza maculata, Molinia, Schoenus, Succisa, Anthoxanthum odoratum, Viola* sp. and *Hylocomium splendens*. *Phragmites* is seen at the junction of this arm and the main body of the flush. At the S side of this arm bog pools containing *Potamogeton polygonifolius* occur with *S. papillosum* growing around the edges (EC 91 µS/cm).

The NW arm is similar to the SW arm as it also consists of a slightly sunken channel with tall *Calluna* and *Myrica* with *Empetrum* along its edges. The channel is very soft and wet in places. The following species were recorded *Molinia, Anthoxanthum, Potentilla palustre, Menyanthes, Carex rostrata, C. limosa, Ranunculus flammula, Succisa, Cardamine, Lemna, Rumex* sp. *Potamogeton polygonifolius, Viccia* sp., *Angelica, Schoenus, Salix, Juncus inflexus, E. angustifolium, Lychnis flos-cuculi, Sphagnum recurvum* and *Aulacomnium palustre*. At the W end additional species noted were *S. ptilchrum, Rhytidiadelphus, Luzula* and *Dactylorhiza maculata*. All around this arm of the flush there are small *Calluna* mounds with enrichment indicators such as *Empetrum, Dactylorhiza maculata, Dryopteris, Menyanthes, Anthoxanthum* and *Hylocomium splendens*. The *Calluna* is tall (80cm) but there are no epiphytic lichens. These circles may occur due to enhanced aeration in the area caused by water movement.

At the N end of this flush a group of tall *Betula* occur (6-7m) close to the plantation (*Pinus contorta* doing well here). At the edges of this area *Calluna, E. vaginatum* and *Myrica* dominate with *S. capillifolium* hummocks overgrown by *Vaccinium oxycoccus*. Under the trees *Myrica* (1-2m), *E. vaginatum tussocks, Empetrum, Dryopteris, Erica tetralix, Vaccinium myrtillus, Calluna, Anthoxanthum, Hylocomium splendens, Aulacomnium palustre, Polytrichum alpestre, S. papillosum, S. capillifolium* and *S. fimbriatum* occur. Epiphytic lichens and bryophytes are common. Bracket fungi (*Pitoporus betulina*) are seen on some of the *Betula*. Southwards *Calluna* and *E. vaginatum* again dominate with *Empetrum* and *V. oxycoccus* and *Pleurozium schreberi* the main bryophyte. Some wet patches occur with *S. recurvum, S. pulchrum, S. cuspidatum* and *Carex limosa*. Two large curved pools infilled with *S. cuspidatum, S. recurvum, S. pulchrum, E. angustifolium* and *Carex limosa* are seen (EC 79 µS/cm, musty smell here like at Shanley's Lough on Clara). These are visible on the 1993 aerial photograph). *Molinia* then becomes more frequent with small clumps of shorter *Betula*.

The main body of the flush is similar to the northern group of *Betula* with some very old tall trees (10m tall and 0.5m dbh). The woodland is quite dense with large *Molinia* tussocks and *Rubus* making it difficult to penetrate. *Salix* trees are also quite frequent, some of which are also very tall for a bog situation. The water table was high at the time of the survey and the growth form of the *Molinia* suggests that the water table is high for a large part of the year. Other species seen here and not at the northern *Betula* area are *Polypodium* sp., *Carex rostrata, Brachypodium sylvaticum, Potentilla erecta, Galium* sp., *Dactylorhiza* sp., *Juncus effusus, Rhytidiadelphus squarrosus, Polytrichum commune, Cephalozia bicuspidata, Sphagnum palustre* and *S. squarrosum*. The EC of surface water in the woodland was 69 µS/cm.

In the channel to the S, which is lined with *Betula* and *Myrica*, *Osmunda* was recorded. *Myrica* and *Molinia* extend into the bog vegetation to the E side of this channel. At the S end of the flush there is a large area dominated by *Molinia*, *E. angustifolium*, *Calluna* and *Myrica* with some scattered *Betula*. This area was fenced off in the past and may have been fertilized or partly reclaimed. The main channel continues through this area to the drain along a small bog road. There is some water flow visible here (EC 69 µS/cm).

Flush X
This is a band of *Phragmites* which runs close to the NE edge of the SE Lobe. It follows on from the channel of Flush Y and may be associated with an underlying ridge of mineral material. Tussocks of *Schoenus nigricans* are also seen.

7. BOG TYPE

This bog has been classified as a Ridge River B bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes
This is a rather flat site which slopes gently into the central flush and towards the SE. Some marginal slopes are also seen. Slopes were estimated in the field and are described below. Their positions are shown on the Slopes Map.

Slope 1 — This is the slope from the NE into a very slight depression with large pools and is at the mid SW of the site. It is 0.25m over 30m.

Slope 2 — This slope is 0.3m over 50m to an old cut-away area with peat regeneration and *Molinia* at the SW edge of the site. It is 0.3m over 50m. The facebank is < 0.75m.

Slope 3 — This slope is also at the SW of the site, through Complex 6/7/9+*Cl*+P into an old cut-away area dominated by *Molinia*, and is 0.2m over 50m.

Slope 4 — This slope at the W of the site, through Complex 6/3+*Cl*, is 0.75m over 50m to an area of old cut-away dominated by *Molinia*. The facebank is up to 1.5m tall

Slope 5 — The slope eastwards from the south-west side of the main flush is approximately 0.75 m over 250 m.

Slope 6 — This is at the NW of the site W to an area of old peat cutting dominated by *Calluna* and is 0.75m over 30m through Complex 6/3/2+*Cl*+TP. The facebank is < 0.5m.

Slopes 7+8 — These two slope are at the NW corner of the site through Complex 7/3/2 +*Cl* into an area dominated by *Calluna* (Slope 7) and an area of regenerating peat (Slope 8). The facebanks in both instances are 1m high.

Slope 9 — This slope is at the N of the site N into an area of old peat cutting dominated by *Calluna*. The facebank is < 1m tall.

Slope 10 — This slope is at the E of the site SE into an area dominated by *Phragmites*. The facebank is < 0.5m.

Slope 11 — This is at the ESE end of the site from Complex 7/9/3+*Cl* SE to the track and is 0.3m over 30m.

Slope 12 — The slope to the N from the centre of the SE Lobe towards the exit of Flush Y is 1.5 m over 100 m.

Slope 13 — This slope is at the S corner of the site and is 0.75m over 100m. There is active peat cutting along both margins and the facebanks are up to 2m tall. Complex 7/6 is associated with it.

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat cutting

Active peat cutting is confined to a few small areas at the edges of this site. There are two small isolated areas of active peat cutting along the W of the site where the facebanks are up to 3m tall. The hopper method of extraction is used. Where Drain bC exits the bog to the NW of the site the active facebanks are up too 1.5m tall. At the SE of the SE lobe small area of active peat cutting is carried out. This is excavated by the hopper method and the facebanks are < 1m tall. At the SW of the SE lobe the bog is bounded by the main road and there is further active peat cutting. Hopper method is again in use and the facebanks are up to 2m tall.

Extensive peat cutting (industrially harvested) is occurring on areas of bog to the S and SW of this site. These areas are separated from the main bog by drivable tracks.

8.2.2 Forestry

There are three forestry plantations at this site. A large area of the high bog (18 ha) to the N is planted with *Pinus contorta*, which is approximately 15 -20 years old. To the S, also on the high bog there is a smaller plantation (5.5 ha) also of *Pinus contorta*. The trees in here are about the same age as those to the N. To the SE, S of the exit of Flush Y and close to the river, a 6 ha *Pinus contorta* plantation is seen. This appears to be either on cut-away or on the natural slope to the river. Many of the trees in this area have failed, possibly due to flooding.

8.2.3 Fire History

Most of this site has escaped burning for some time. *Calluna* is generally tall (30-40cm extending to 60cm in Complex 7/9) and *Cladonia portentosa* cover is high over much of the bog. There were no areas of recent fire damage.

8.2.4 Dumping

A number of old cars are dumped in places around the cut-away. In addition, on the small road which runs along the E side of the southern plantation, extensive littering of cardboard boxes, cartridge cases and clay pigeons is seen. This is being carried out by the Bellinagare and Frenchpark gun club who obviously have clay pigeon shoots here.

8.2.5 Cattle Poaching

Cattle poaching is evident along small areas to the NNE. Cattle graze the flood plains of the river during the summer and gain access on to the bog in areas where tbe fence has collapsed. The poaching is not severe.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. The flush on this site is associated with a very shallow depression and dilute regional ground water inputs.

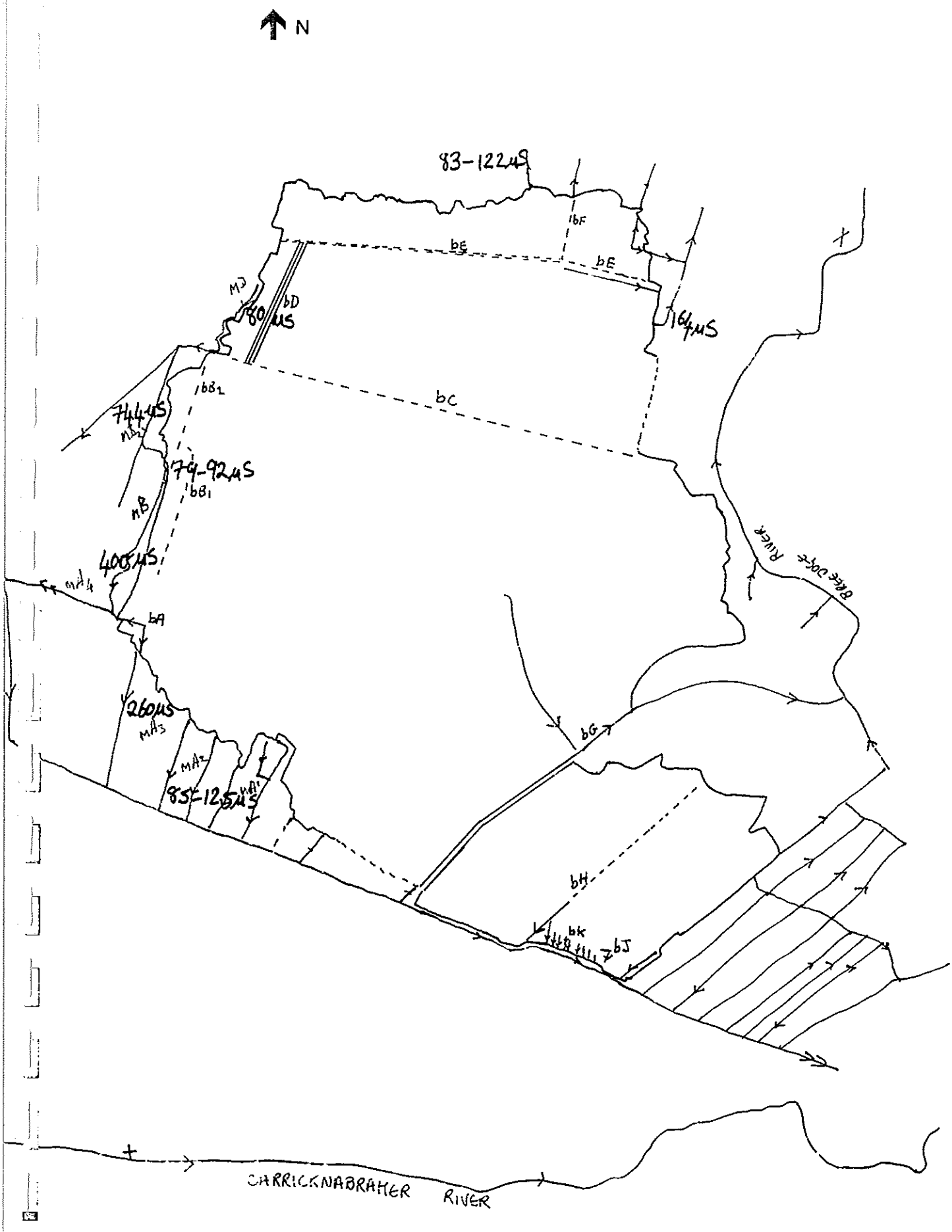
2. At the E of the site an area dominated by *Phragmites* and *Molinia* marks the site of an old lake which is now drained. This drainage was probably caused by a lowering of the regional ground water table related to dredging of the adjacent Breedoge River.

3. The site has not been burnt for some time. *Calluna* is tall and *Cladonia portentosa* cover is high. This may also be associated with drying out as only small areas of central vegetation complex.

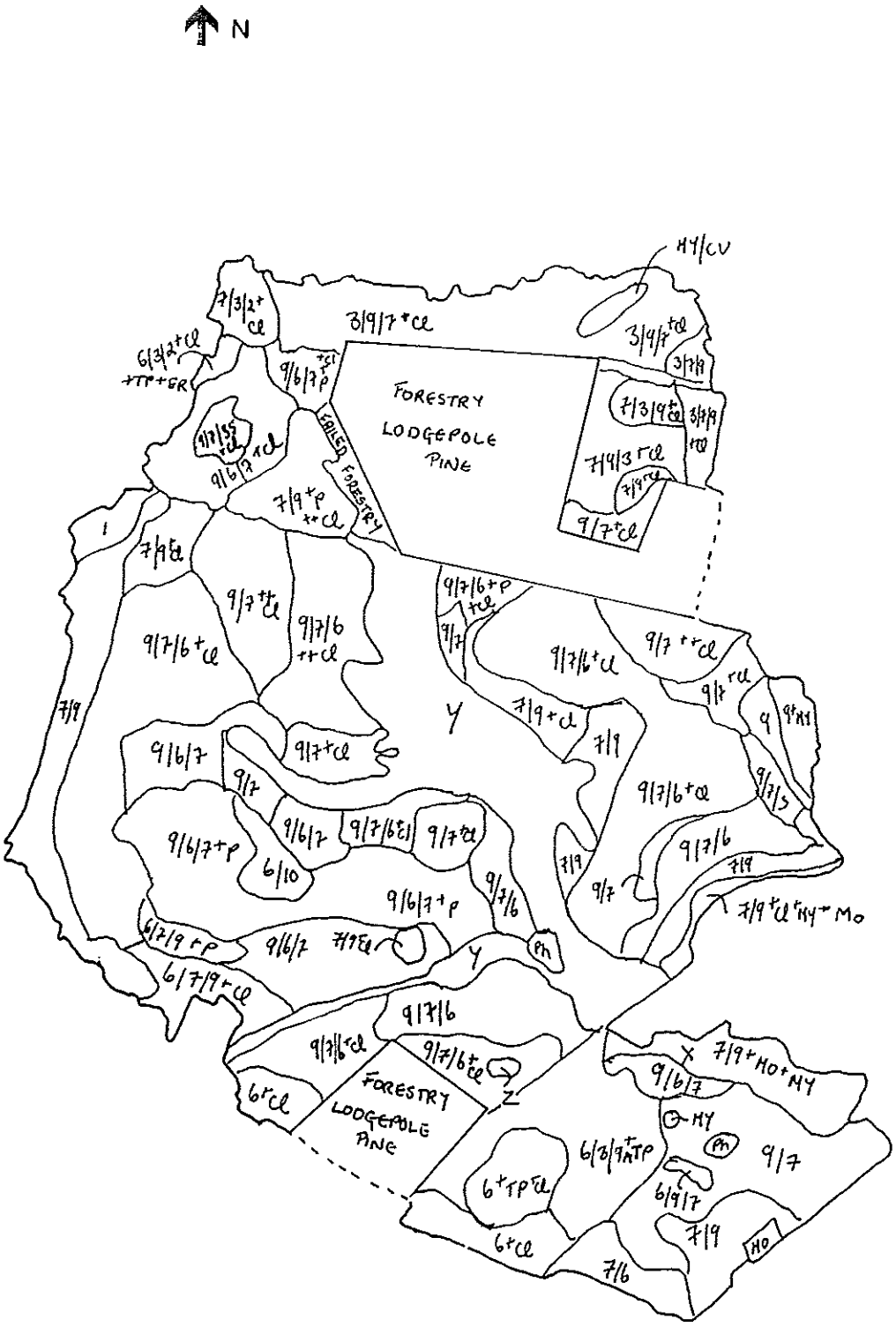
Lara Kelly
Marie Dromey
Malcolm Doak

Raised Bog Restoration Project (1995).

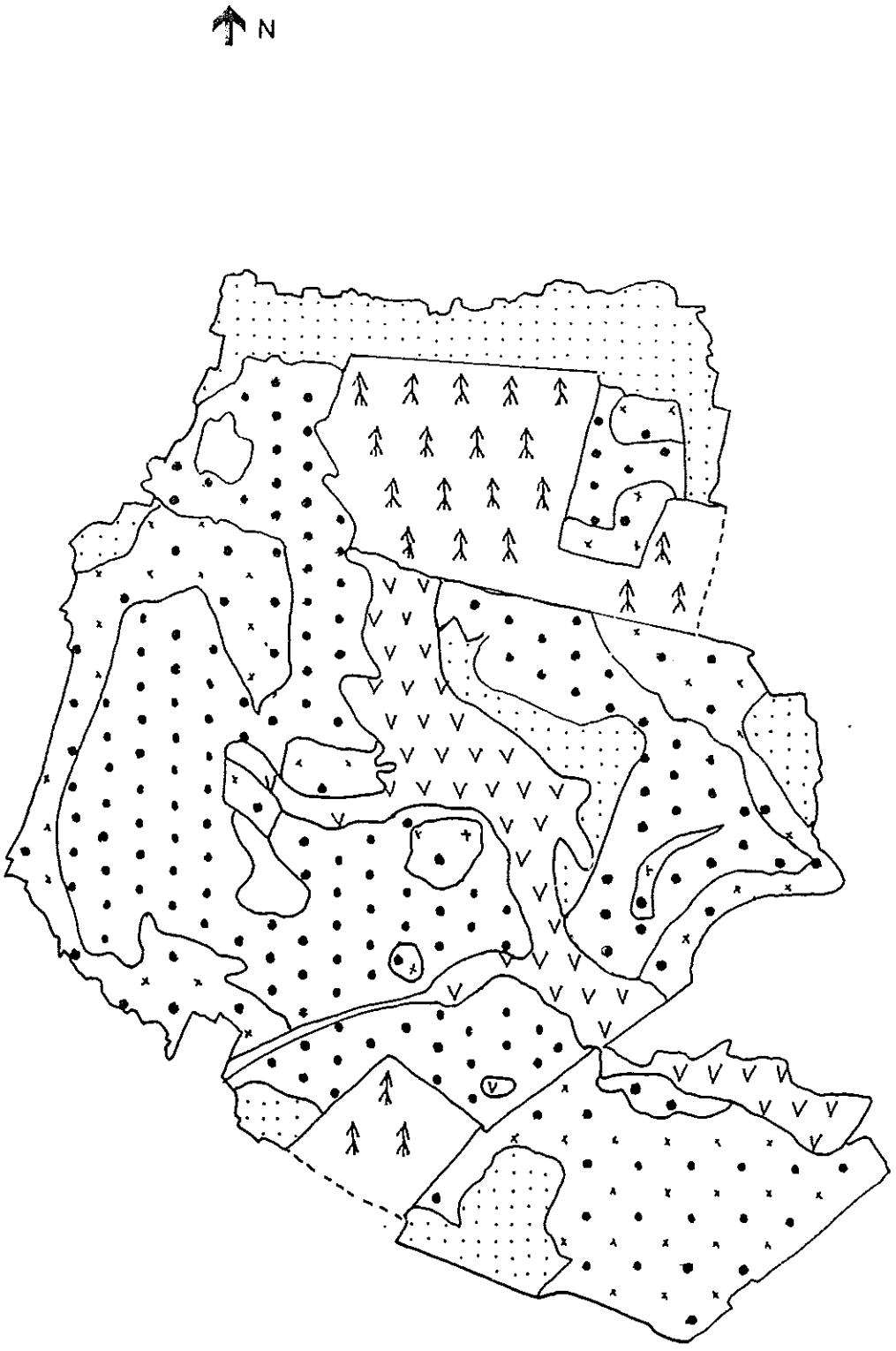
CLOONSHANVILLE BOG, CO. ROSCOMMON (614).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994



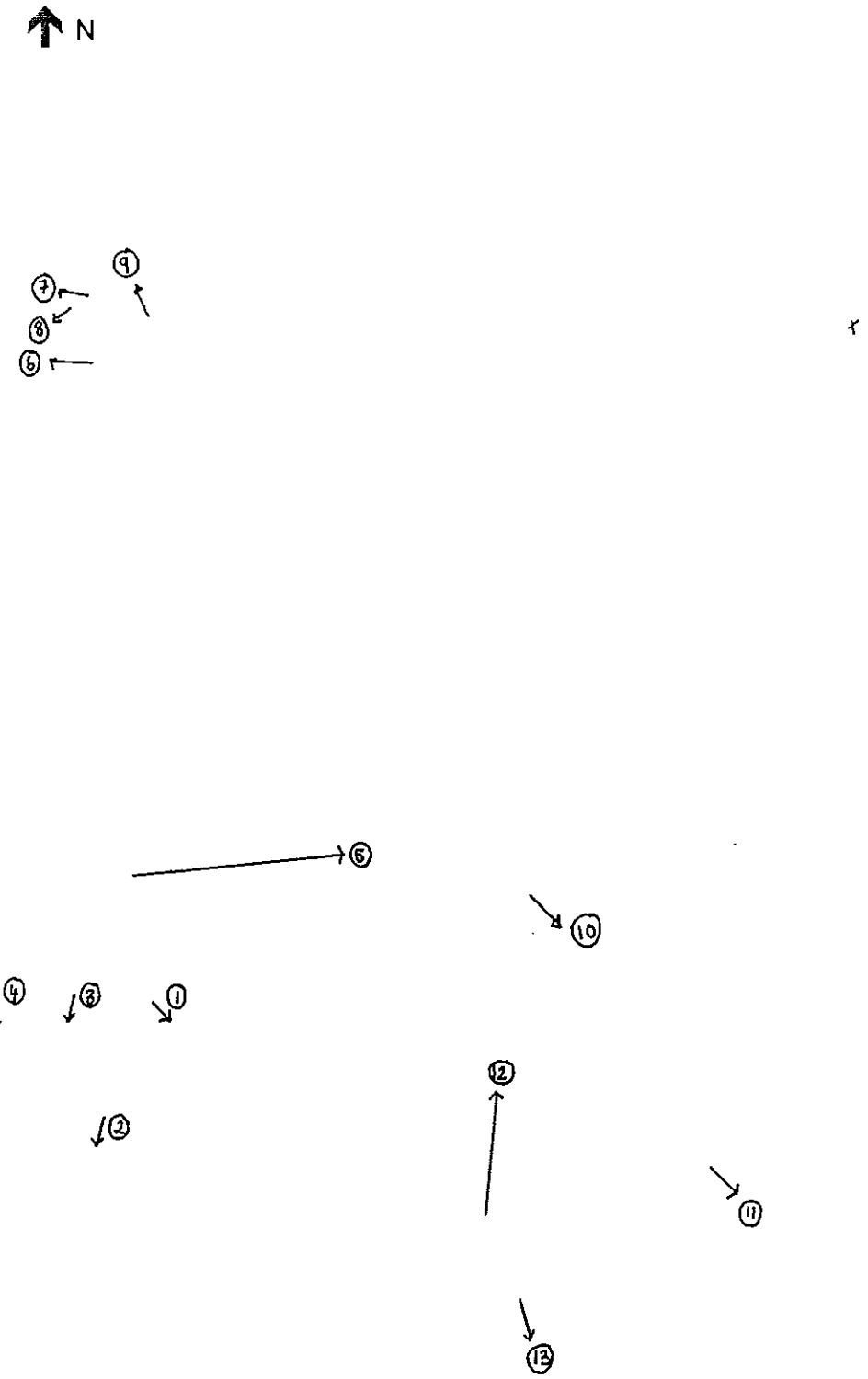
CLOONSHANVILLE BOG, CO. ROSCOMMON (614)
VEGETATION MAP (1:10,560)
1994



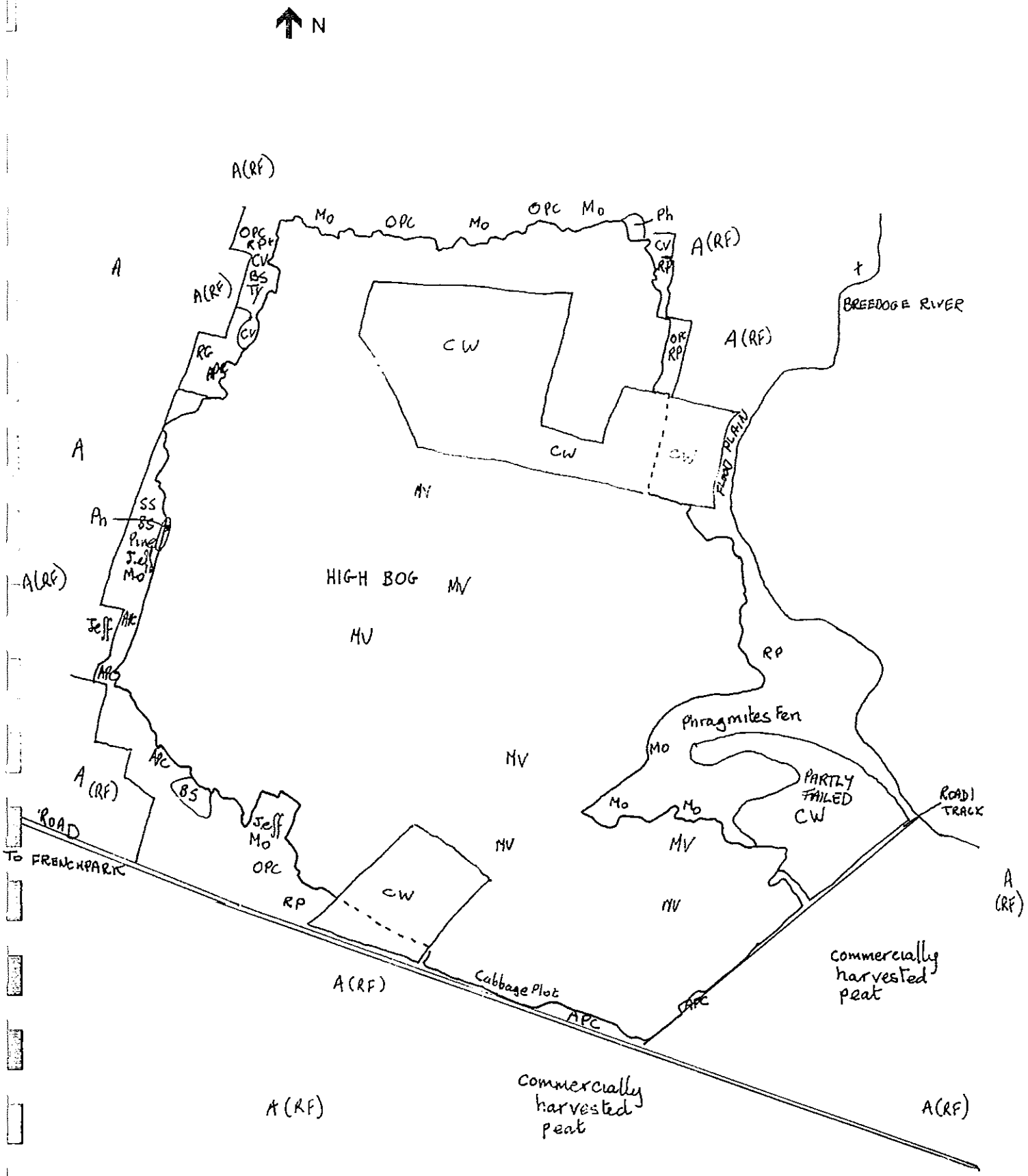
CLOONSHANVILLE BOG, CO. ROSCOMMON (614).
ECOTOPE MAP (1:10,560)
1994



CLOONSHANVILLE BOG, CO. ROSCOMMON (614).
SLOPES MAP (1:10,560)
1994



CLOONSHANVILLE BOG, CO. ROSCOMMON (614)
LANDUSE MAP (1:10,560)
1994



CORBO BOG, CO ROSCOMMON

1. SUMMARY OF SITE DETAILS

NHA No.	602	1/2" Sheet:	12
Grid Ref:	M 94 69	6" Sheet:	RN 36
GSI Aerial Photo:	M 3	1:25,000 Sheet:	17/27 SE
NHA Photo:	663:0-6 and 24-25	Area (ha):	121.0 (High Bog)
Date(s) of Visit:	24-4-1994 (Ecology)		
	Not visited (Geohydrology)		

Townlands: Corbo, Cloonageeragh, Clooncashel Beg, Ballintober South, Coolshaghtena, Carrowcrin and Cloontimullan.

2. INTRODUCTION

2.1 BACKGROUND

This bog is only a remnant of a much larger bog which has now been mostly cut-away. A curvilinear section of high bog remains. Corbo was visited by Douglas and Mooney (1984) as part of the National Raised Bog Survey and was assigned a Bi rating. It was described as having a good *Sphagnum* cover. However much of the site had been affected by fire and no large hummocks were seen. Quaking areas and a number of small flushes are described, one of which had *Carex rostrata* growing in it.

The bog was also visited by the NHA Survey team (1994). It was described in their report as having a large area of active raised bog with extensive areas of pools (mostly *S. cuspidatum*) and hummocks (approximately 40% of the dome). Flushes are also described. *Juncus effusus* and *Molinia* were the dominant flush species. It was considered worthy of NHA designation (regional importance).

Parts of the site are owned by Bord na Mona and are on offer to NPWS.

2.2 LOCATION AND ACCESS

This bog is situated approximately 5.5km north east of Roscommon town and just to the north of the N63 between Roscommon and Lanesborough. It is the most westerly of the midland northern group of raised bogs surveyed during this project.

3. METEOROLOGY

This site was not visited by the hydrogeologist and so there is no information for this section.

4. GEOMORPHOLOGY

This site was not visited by the hydrogeologist and so there is no information for this section.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

This site was not visited by the hydrogeologist and so there is no information for this section.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology (See Drains Map).

South

Drain Complex bD is a series of 17 new drains which have been recently excavated preparatory to peat cutting. They are seen along the mid-eastern section of the south end of the bog (PL4: 24) and are approximately 7m apart. They are 1.5m deep by 1m wide. There is a little water in them with no flow. A line of stakes across the bog defines the limits of the property being prepared.

Drains bB and bC are old and are seen at the south of the south end of the site. They are shallow and infilled with *Sphagnum cuspidatum*. Slight flow is evident.

West

Drain bA is long and runs parallel to the excavated 8m vertical face bank at the south edge of the left arm (P.M.5). It is 3m deep by 2m wide with 1m of non-flowing water. There is no vegetation growing in it

5.3 HYDROCHEMISTRY

This site was not visited by the hydrogeologist and so there is no information for this section.

5.4 GEOHYDROLOGICAL OVERVIEW

This site was not visited by the hydrogeologist and so there is no information for this section.

6. VEGETATION

6.1 VEGETATION SUMMARY

Much of the high bog, especially in the vicinity of the flushes is very wet and quaking. The vegetation of the inter-pool areas is dominated by a very good *Sphagna* cover. Away from the flushes the *Sphagnum* cover is still good but the pools across the high bog are more linear in appearance with many of them bare. To the west of the west arm is a band of vegetation running from north to south which is dominated by *Myrica gale* and *Molinia caerulea*. The lower slopes at the northern section of the site are dominated by *Carex panicea*, *Narthecium ossifragum* and *Rhynchospora alba* while those at the south end of the site support much *Trichophorum cespitosum*.

Pleurozia purpurea and *Campylopus atrovirens*, species associated with blanket bog and which have been found on the western group of bogs visited as part of this survey, were not found on this bog. *Andromeda polifolia*, a midland raised bog indicator species, was found in all vegetation complexes of this bog.

On the older cut-away areas *Betula* and *Ulex* are found along the north of the west arm; *Ulex* at the north east of the site; *Betula* along the east of the south end of the site and *Molinia* along the flat areas with *Betula* in the drains of the cut-away to the south and south west of the west arm.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

There is a narrow facebank complex dominated by *Calluna vulgaris* around most of the site. It is not found where peat cutting is on-going, for example, where the road/track leads on to the bog at the south of the west arm and at the north of the west arm in the vicinity of the steep vertical excavations.

Complex 3

This *Carex panicea* dominated marginal vegetation complex corresponds to an area on the southern side which was burnt and to disturbed areas on the other slopes where it is found. The disturbance is probably caused by the active peat cutting and the deep vertical edges of the bog. Burning is evidenced by the presence of *Campylopus introflexus* and *Cladonia floerkeana* and much bare peat. *Sphagnum* cover is low and there is no acrotelm layer. Algal pools occur with 15-20% *Rhynchospora alba* cover around the edges with much dead *Sphagnum cuspidatum* present in them. Small amounts of *Leucobryum glaucum* were found on the west arm of the site. On the approach to Flush X from the south, this complex is found on a ridge. Here the *Calluna* is quite tall (20-30cm) and there are *Cladonia* species present including *C. subcervicornis* ssp. *verticillata*. It seems that this area has escaped burning in the recent past. *Cladonia glauca* was also found here.

Complex 3/2

The vegetation of this complex is broadly similar to that of Complex 3 except that in addition there is a high occurrence of *Trichophorum cespitosum*. There is an increase in both the number of algal pools and *Rhynchospora fusca*. Where this complex occurs at the northern edge of the west arm there is a steep slope of approximately 70cm over 40m. There is active peat cutting with a vertical drop of 3m at the edge of the bog. (PL4:19 looking down this slope). There is slumping and cracking of the peat near this edge of the bog. There is also erosion at the north east of the site where this complex is found. There is a variation of this complex found along the southern edge of the west arm. Here, there is much *Erica tetralix* present. At the southern tip of the south end of the site *Narthecium* (Complex 3/2/6) and *Rhynchospora alba* (Complex 3/2/4) become frequent. The area is extremely dry with cracks, slumping and erosion evident.

Complex 4

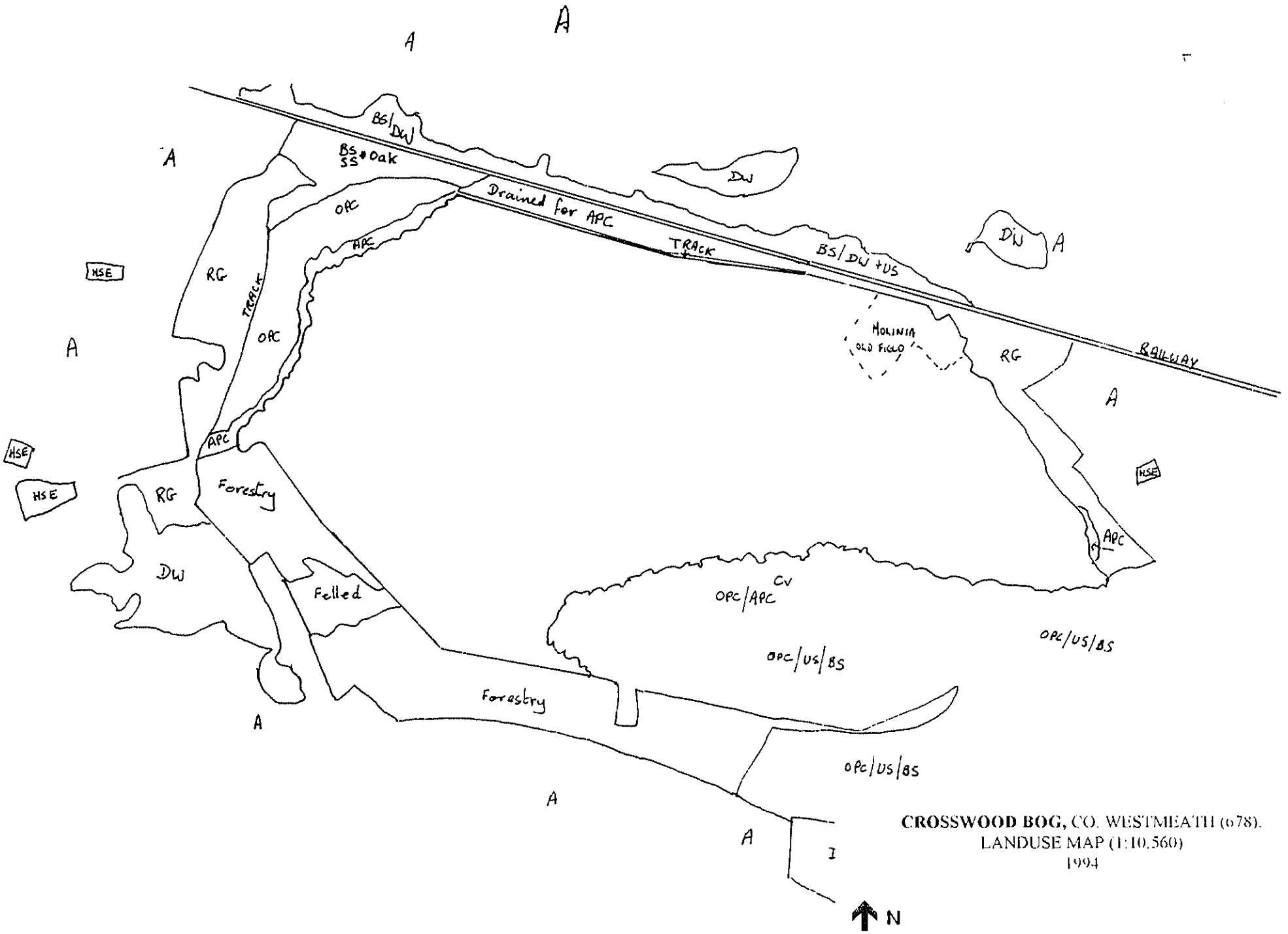
This complex is dominated by *Rhynchospora alba* and is found on steep slopes at the western end of the west arm, the north east of the site and at the south west of the southern end of the site. Active peat cutting is on-going at the margins beside these areas. There are many algal pools, bare peat and erosion channels present. Indications of a history of burning are the presence of *Campylopus introflexus* and *Cladonia floerkeana* (PL4:22 at the west of the left arm). There is no acrotelm layer. Complexes 3 and 6 - the latter is dominated by *Narthecium* - are found in association with it.

Complex 3/4

This vegetation complex is found in three areas; one to the very south west of the west arm, another at the mid-east edge and the other at the southern end of the south of the site. It contains vegetation communities similar to Complexes 3 and 4 but as one walks across it there are patches dominated alternatively by *Carex panicea* or *Rhynchospora alba*. The areas of this vegetation complex differ from each other in that the more southerly site, which was burnt more recently, supports *Huperzia selago* near the facebank and very little *Cladonia* throughout. At the easterly location there is slumping and severe cracking on a very steep slope to the SSE. There is a drain at the edge (EC 190 µS/cm) with *Typha latifolia* growing. At the more westerly location, which is bounded on the south side by a vertical facebank approximately 8m deep (PL4: 23 and PM5), there is greater *Cladonia* cover and small patches of *Racomitrium lanuginosum* and *Myrica gale*.

Complex 3/6

This is found west of flush Y on the west arm of the site and is surrounded by the vegetation of Complexes 3 and 6. There is virtually no acrotelm layer and the *Sphagnum* cover is low. There is high cover of *Cladonia* species including *C. furcata*, *C. portentosa* and *C. uncialis*.



CROSSWOOD BOG, CO. WESTMEATH (678).
LANDUSE MAP (1:10,560)
1994

There is no *Molinia* at flush Y (P.L.4: 20 looking SW to it) while the *Molinia* growth at the edges of flushes W and V (PM. 11) is quite extensive. There are scattered *Betula* and *Pinus* species at flushes Y, W and V.

Flushes Z (P.L.4: 18), Y and X are in a depressed area. There is a ridge running in an arc from south to west about 150m from Flush X (extent of Complex 15) sloping down towards the northern end of the west arm where there is active peat cutting with vertical facebanks excavated to a depth of 3 -5 m. Flush W (EC 60 µS/cm), which is quite extensive is in another depressed area to the north east of the site (PM. 6-10). The ground here slopes in an ENE direction where again there are deep drains at the edge. Flush V is in an area which is more or less flat. Below it and to the north west the ground slopes away.

7. BOG TYPE

This site was not visited by the hydrogeologist and so there is no information for this section.

8. HUMAN IMPACT

8.1 RECENT HUMAN IMPACT (See Landuse Map)

8.1.1 Peat Cutting

Parts of the bog are very wet and quaking. There are five small flushes present. These are probably due to local subsidence as a result of deep drains and active peat cutting around the margins.

Active peat cutting is carried out all around the site except at the far western edge where the peat has been cut-away in the past. Most peat cutting has been carried out to the SE and SSW of the site and least peat cutting has occurred around the NE arm although the amounts are still significant. Drains at the face banks, especially at the north and south-eastern margins of the west arm and the north and east edges of the southern end of the bog, are vertical and range from 3-8 m deep (PL4:19 looking down the slope at the north eastern side of the west arm; PL4:23 looking eastwards showing the vertical bank 8m deep at the south of the west arm; PM5 with a similar view but also showing the parallel drain bA on the high bog).

There is severe cracking of the peat in the *Calluna* dominated edges at the north east of the site; east and west (PL4:25) of the south end and at the west of the west arm. Active peat cutting appears to be on a commercial basis with the excavation of deep drains being carried out at these face banks The water level in the cracks at the west of the south end is quite high (PL4: 25).

8.1.2 Fire History

Douglas and Mooney (1984) state much of the site had been recently affected by fire and no large hummocks were seen. The area where Complex 3+Pools occurs was burnt in 1984 (Cross, 1987 in field notes). *Cladonia floerkeana* and *Campylopus introflexus* were frequently seen around the site during this survey (particularly in Complexes 3 and 4) indicating past disturbance, most probably fire.

8.1.3 Dumping

There is some dumping of household and farm refuse along the access road into the site.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. The flushes and wet areas on this site are located in subsidence hollows where water ponds.

2. There are extensive excavations along both edges of the west arm and along the east of the south end of the site so that the bog along both arms is quite narrow. Drainage impacts are therefore severe. The vegetation cover reflects this with a high cover of communities indicating marginal conditions. In addition cracking and slumping of the bog surface is common. This causes an even greater water loss.

3. A strip of vegetation is seen running north/south across the west arm of the site. It is dominated by *Myrica gale* and *Molinia* with small patches of *Schoenus nigricans* and *Stellaria* species. It may be associated with an underlying mineral deposit.

Lara Kelly
Malcolm Doak
Marie Dromey

Raised Bog Restoration Project (1995).

CORBO BOG, CO. ROSCOMMON (602).
DRAINS MAP (1:10.560)
1994

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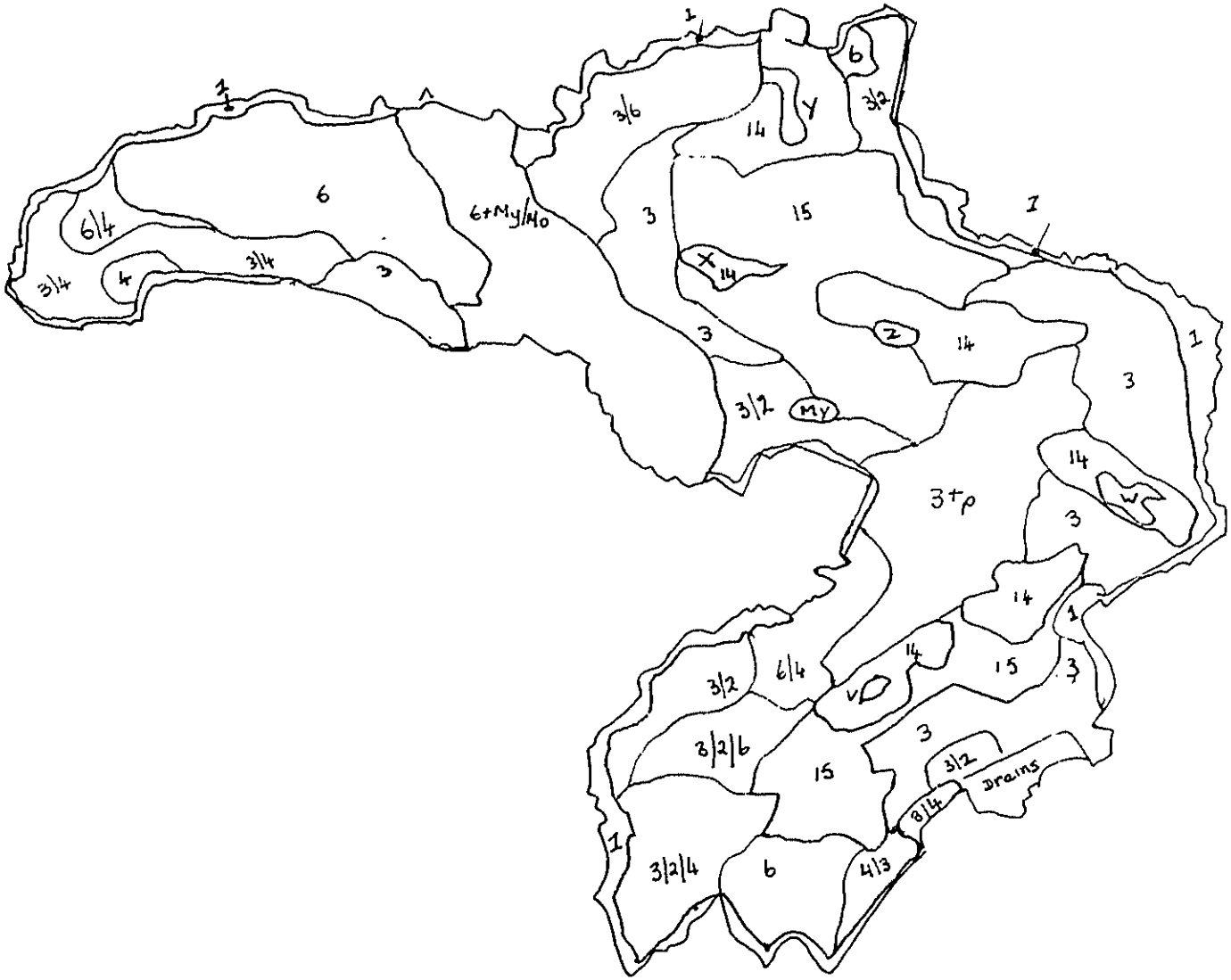

CORBO BOG, CO. ROSCOMMON (602).
VEGETATION MAP (1:10.560)
1994

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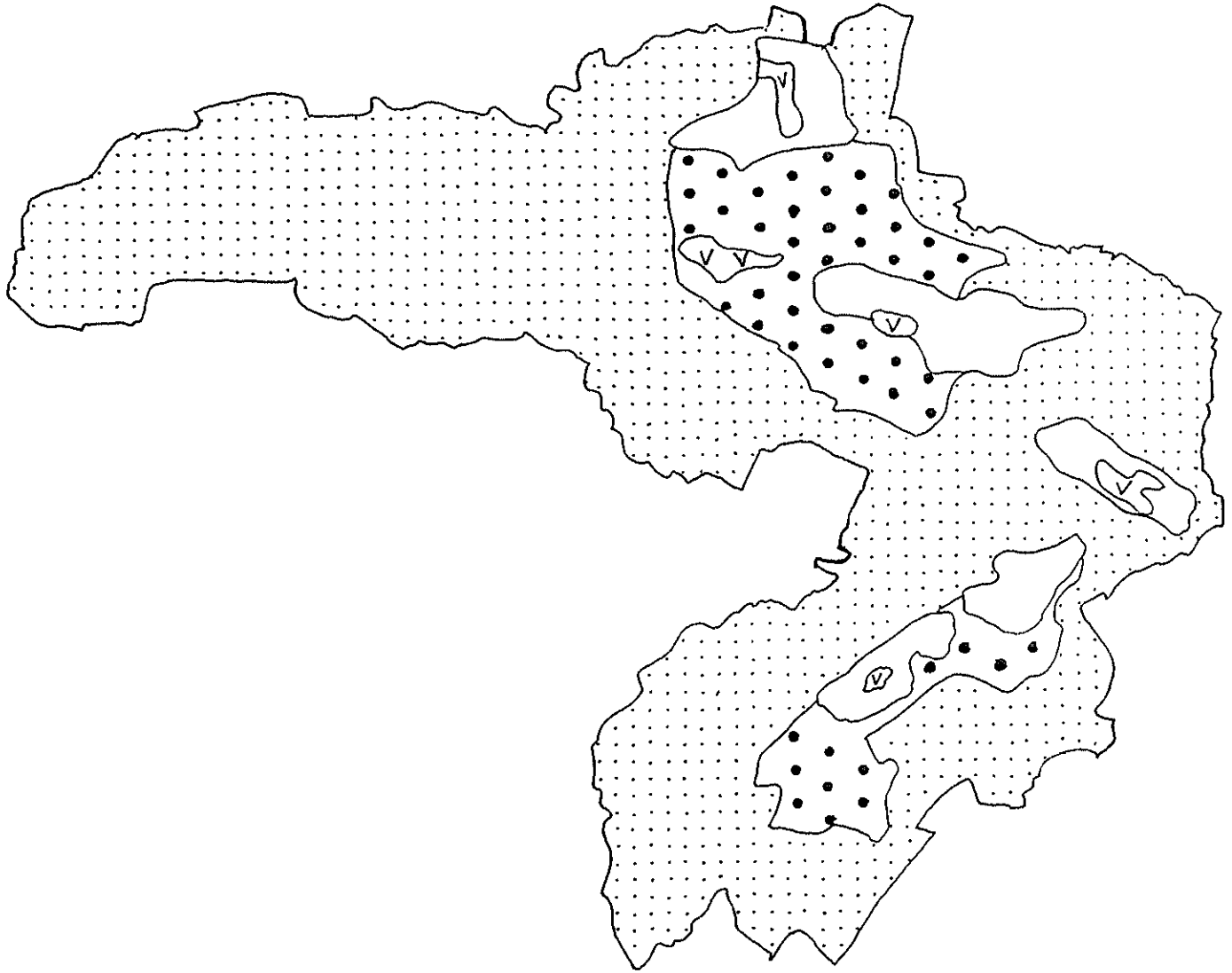

CORBO BOG, CO. ROSCOMMON (602).
ECOTOPE MAP (1:10,560)
1994

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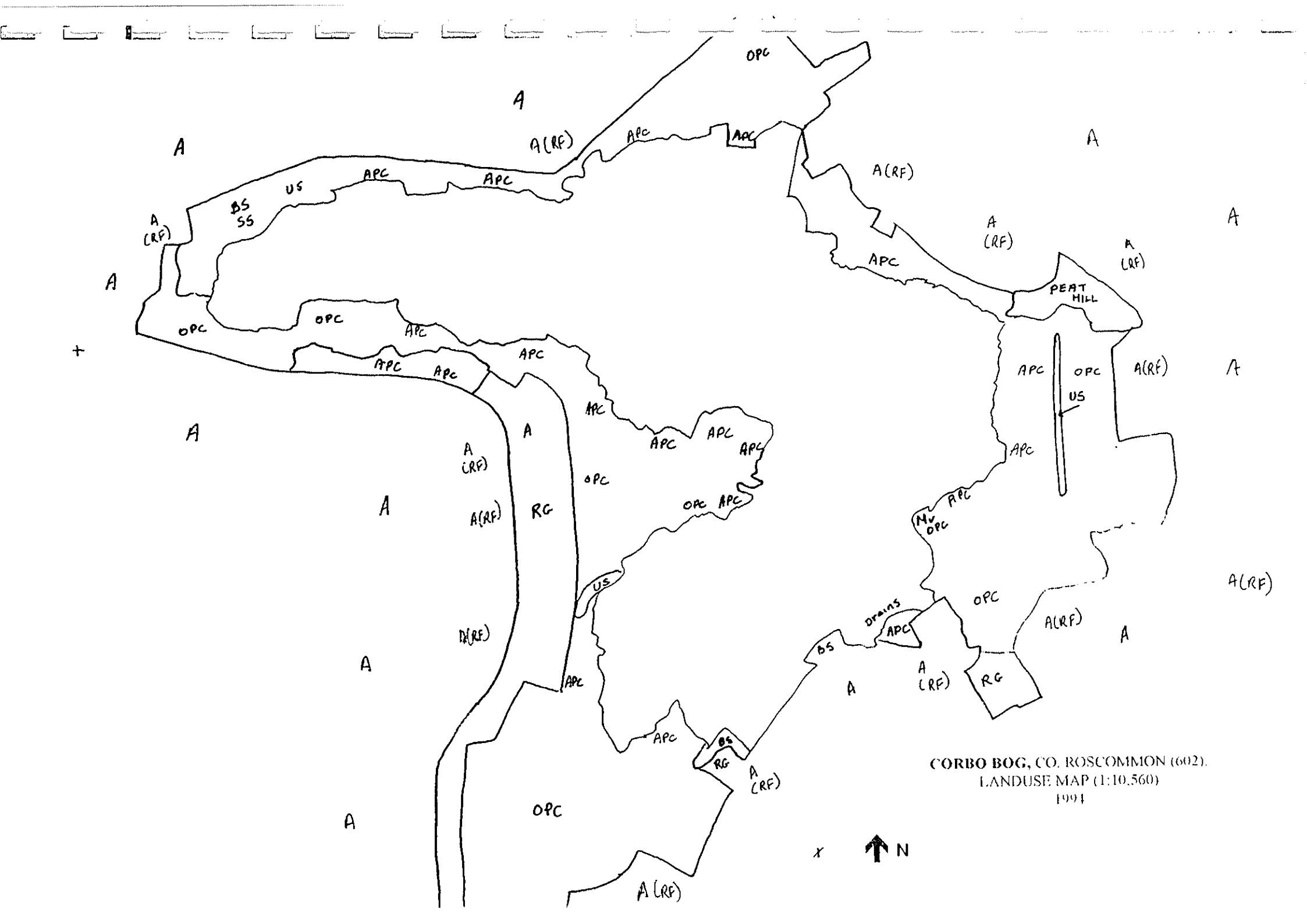


CORBO BOG, CO. ROSCOMMON (602).
LANDUSE MAP (1:10,560)
1994

CROSSWOOD BOG, CO. WESTMEATH

1. SUMMARY OF SITE DETAILS

NHA No:	678	1/2" Sheet:	15
Grid Ref:	N 085 405	6" Sheet:	WT 29
GSI Aerial Photo:	N 572	1:25,000 Sheet:	20/23NW, 20/23SW
Other Photo:	OS 3375 (1993 Col.)	Area (ha):	110.0 (High Bog)
Date(s) of Visit:	15/3-/1994 (Ecology) 30/3/94 & 13/4/ 1994 (Geohydrology)		

Townlands: Crosswood, Creggan Upper, Creggan Lower, Moydrum and Glenaghanvoneen.

2. INTRODUCTION

2.1 BACKGROUND

Crosswood is the most northerly of the central midland bogs to be visited during this survey. It contains a number of large wet areas and a pine flush in its centre. It was assigned a Bi rating following The National Raised Bog Survey (Douglas and Grogan, 1986; Cross, 1990). The presence of notable amounts of *Sphagnum pulchrum* makes this an unusual site.

There is extensive cut-away around the edges of this bog, particularly to the south-east of the site, and many drains have been inserted on the high bog. A road runs along three sides of the site with newly deepened drains along the western and north-eastern edges associated with the road. Despite these features, much of the intact bog is still quite wet. There is a flush zone on the intact bog which shows signs of having been burnt in the past (Douglas and Grogan, 1986). A large proportion of the site is owned by BnM and is on offer to NPWS.

2.2 LOCATION AND ACCESS

This bog lies approximately 5km east of Athlone in Co. Westmeath. It is immediately south of the Dublin/Galway railway line and just to the north-east of the main Dublin/Galway road (N6). It is a relatively isolated bog and is the most northerly of the central midland group.

3. METEOROLOGY

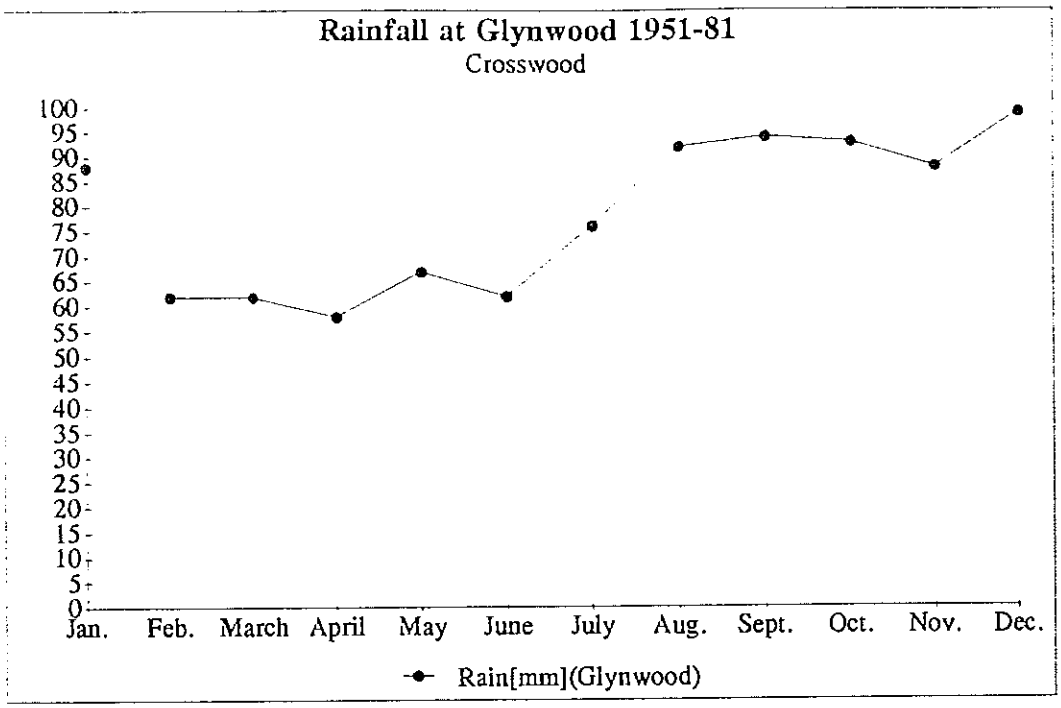
No meteorological measurements have been made on Crosswood Bog. However, the rainfall isohyte map of Co. Westmeath shows that this area receives approximately 941mm of precipitation per year. Fig. 13 shows the average monthly rainfall for the Glynnwood rainfall station which is found approximately 300m to the south-west of the site. The table shows a roughly even distribution of rainfall throughout the year. PE for Crosswood was calculated as approximately 455mm/yr based on data from the synoptic weather stations at Birr and Mullingar.

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that the year round actual evapotranspiration (AE) from Crosswood bog is greater than the stated PE value calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Crosswood would therefore be greater than 455mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 486mm/yr.

Figure 13:



Meteorological data for Crosswood Bog (1951-1981) are summarised below:

Rainfall (P)	941mm/yr
Actual Evapotranspiration, (AE)	>455mm/yr
Potential recharge, (PR)	<486mm/yr

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

Peat bog covers much of the low lying ground in this area. In plan, the site has an approximately elliptical shape. It reaches its maximum length of 1600m in an ENE-WSW direction. It is thinnest in a north-south direction where it has an average width of 580m.

Crosswood bog rarely exceeds 62m OD in height. The bog has a relatively steep gradient around its margins which becomes gentler moving towards its highest point in the centre. The marginal slope has been increased in many areas as a result of subsidence caused by drainage. Widespread slumping and cracking have been observed on the high bog immediately adjacent to face banks on the western and southern sides of the site.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

Crosswood Bog is surrounded on its northern and eastern sides by moderately sloping higher ground. Reclaimed peatland to the west and south of the site is generally flat and at a lower elevation.

The higher ground in the surrounding site has an irregular undulating surface. It has a slightly higher average elevation than the bog (65m AOD approx.). An east west trending linear ridge is found on the northern side of the bog. This features has been identified as an esker using aerial

photographs. A number irregularly oriented mounds are found closely associated with the esker and near the south eastern bog margins.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Bedrock geological maps of the Irish Midlands (Hitzman, 1993) show that Crosswood Bog is underlain by Lower Carboniferous Argillaceous Bioclastic Limestones. The maps show bedrock coming into contact with younger Waulsortian Reef Limestone immediately north of the site. Outcrop can be seen approximately 600m to the south of the bog's southern margin.

Argillaceous Bioclastic Limestone and Waulsortian Reef Limestone are generally regarded as a poor aquifers/aquitards, although they may be locally productive, particularly in areas affected by faulting.

5.1.2 Subsoils (See 6" 1840s Map)

No recent subsoils data were available for Crosswood bog, apart from those contained in geological maps produced in the 1840s. No subdivision of units was made on these maps apart from the distinction between bog and inorganic deposits.

Soils maps for Co. Westmeath show the inorganic soils covering the area around the bog to belong to the Patrickswell Series. Soils Survey memoirs describe the series as grey brown podzolics made up of loam and silt loam derived from limestone parent material. The maps show the soils immediately surrounding the bog to be made up of various forms of reclaimed peatland.

Little geohydrological data exists for the area. Well records showed that domestic wells surrounding the bog have low yields, typically less than 100 gph. Unfortunately, no information exists concerning well construction details or the deposits supplying the water to the source.

Inorganic subsoils

The inorganic subsoil geology of the deposits surrounding Crosswood Bog is dominated by Plesitocene glacial and fluvioglacial deposits. Sands and gravels form the positive topographic feature in the area. Lower lying ground is dominated by limestone till.

Little time has been available to examine the inorganic deposits in any detail. Nonetheless, the higher ground around the bog margins is well drained suggesting that the inorganic subsoils surrounding Crosswood Bog are reasonably permeable. Measurements made on esker deposits around Clara Bog showed them to have permeabilities of between 10^0 m/day and 10^2 m/day. The deposits in this area are suspected to have similar values.

Glacial tills have a wide range of potential permeability values. Deposits immediately around the bog margins had moderate amounts of fine grained material (up to 40%). This suggests that the till has a low permeability. However, the absence of field drains indicates that it may be higher.

The coarse deposits found around the bog margins contrast with the finer grained material found below the peat. Recent observations made as part of this survey suggested that much of the bog had a substrate of dense, blue grey clay. It is suspected that this unit contains some sand and occasional pebbles close to the original bog margins. The deposit bears a strong resemblance to that found below Clara and Raheenmore Bogs.

The clay underlying the bog is believed to have a low to very low permeability. Tests carried out on similar deposits containing no coarse material showed it to have a value of less than 1×10^{-4} m/day. However, permeabilities are suspected to be higher around the bog margins where the unit contains a higher proportion of coarse material.

Peat
Peat is the youngest subsoil type in the area. The 1840s map shows bog covering most of the low. The extent of the bog has been significantly reduced since these maps were made.

5.1.3 Depth to Bedrock
No depth to bedrock information exists for below Crosswood Bog. However, borehole records for the surrounding area indicate that rock is between 0m and 17m below ground surface, although depths of between 6m and 7m are more typical.

The influence of bedrock on the regional hydrogeology of the area is not known.

5.2 HYDROLOGY

The site and its surroundings are found within the middle reaches of the Shannon Catchment (Area 11,689 km^2).

5.2.1 High Bog Hydrology
A number of drains are found on the high bog. They are discussed separately below and are illustrated on the Drains and Hydrochemistry Map.

Drains bA to bE are five new deep drains (drains bA - bE) along the north-west boundary have been inserted since the 1993 aerial photos (O.S. 3375) were taken. They must therefore have been dug during the winter '93/'94. They are parallel to each other and extend approximately 150m on to the wettest part of the high bog. They are about 1m deep by 0.75m wide. There is no vegetation present. There was considerable water flow during the survey period towards drains bH and bK.

These five new drains flow into drain bK which in turn flows into drain bG through linking drains. Drain bK was excavated prior to 1973 (G.S.I. N572) and is now being incorporated as part of the drainage at this north-west end of the site. There is flow to the W into Drain mB2.

Drain bF is an old east-west trending drain which is found on the southern half of the bog. It also forms part of a townland boundary. It is a double drain for half its length - along the western section - and was dug prior to 1973 (GSI aerial photograph N572). The drains are approximately 1m deep and up to 1.5m wide and filled with algae. There are two mature *Pinus sylvestris* immediately to the north of the drain. Water flow is to the eastern and south-western margins.

Drain Complex bJ: Between Drain bF and the south-west edge of the bog a number of N/S perpendicular drains have been inserted in the more recent past. These have been dug since 1973 and are much narrower (0.5m wide) than Drain bF. The water flows both towards Drain bF and towards the cut-away. The combination of all these drains at this end of the site has rendered it very dry with tall *Calluna* present.

Drain bH is an older double drain which runs diagonally through the N/S Drain Complex bJ. It is older than them and was present on the 1970s aerial photograph. There is no vegetation present and the water flow is again towards the cut-away.

5.2.2 Bog Margin Hydrology
The hydrological regime of the bog margins is dominated by a number of drains. These features were examined on the 13-4-1994 during a long dry spell. Water levels were low at this time. Drain locations and directions of flow have been shown on the Drains and Hydrochemistry Map. The principal drains are discussed separately below.

Drain mA: This drain has two branches mA1 which flows northwards along the western margin of the bog and mA2 which flows westwards along the north western margin. mA1 is fed by drains from the turbary complex on the western side of the bog. Drain mA2 drains the turbary area on the north western side of the bog. Both drains coalesce and discharge into a large westerly flowing stream to the north of the site. The drains are up to 1.5m wide x 2.0m deep. They contained approximately 0.3m of water along much of their length during the survey period. It was largely free of vegetation.

Drain mB: This drains has two branches, mB1 and mB2, which flow along the northern margin of the bog. mB1 flows eastwards and mB2 flows westwards. mB1 and mB2 drain much of the northern uncut section of bog. The two drains coalesce and discharge into the large stream to the north. The drain is up to 1.5m wide and up to 2m deep. Less than 0.2m of water was noted in it when examined. Much of mB is vegetated but contains little *Sphagnum*.

Drain mC flows northwards along the north-eastern side of the bog. It drains the north eastern part of the bog and the adjacent agricultural land. mC flows into the northern stream which is found close to northern margin of the bog. The drain is up to 0.75m deep x 1.0m wide. Approximately 0.5m of water was noted along much of its course. It is vegetated along much of its course.

Drain mD: This drain drains the south eastern margin of the bog. It has two branches, mD1 which flows to the south west and mD2 which flows to the east. Both drains coalesce close to the south - eastern extreme of the high bog. mD1 drains the south western part of the uncut bog and the cut-over peatland to the south west of the site. mD2 drains a large part of the southern turbary area. mD discharges to a large westerly flowing stream to the south of the site. The drains are up to 1.5m deep x 1.0m wide and contained up to 0.4m of water. These drains are largely unvegetated.

Drain Complex mE is a number of short drains which flow along the southern margin of the bog. They drain the southern turbary complex and much of the southern side of the uncut bog and discharge to the stream to the south of the site. The drains are up to 1.5m deep x 1.0m wide and rarely contain more than 0.3m of water.

The catchment divide between the water drains discharging to the north and to the south of the site is shown on Drains and Hydrochemistry Map.

The first detailed maps of Crosswood Bog were made in the 1830s. Few drains were shown around the bog margins at this time, indicating that most of those which were surveyed, were cut in the succeeding 150 years.

5.3 HYDROCHEMISTRY

A brief hydrochemical survey of the waters found on and surrounding the bog was carried out on the 13th of April 1994. The survey consisted of two components, a field hydrochemical survey and a water sampling programme for laboratory analysis. The results of the survey have been used to obtain an insight into the hydrogeological regime operating in this area.

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map)

A brief EC survey of the waters flowing from the bog and from the adjacent inorganic subsoil was carried out. Waters flowing from the bog had low ECs, typically less than 100 µS/cm. These values are similar to those of rainfall reflecting the largely inert nature of the peat. (It has not been possible to differentiate between rainwater and bogwater using EC.) In contrast, the EC of the regional groundwater flowing from the inorganic soils is greater. Values of over 100 µS/cm were often observed in waters flowing in drains on inorganic deposits. The higher conductivity of this water is believed to be a reflection of the more reactive nature of the inorganic deposits.

It is notable that peat mineralisation, commonly found around bog margins, is believed to have little effect on the EC of bog water. Eutrophication, a result of nutrient release due to mineralisation, has been noted close to some peat facebanks in the area yet no measurable change in EC was observed.

The difference in EC between the bog water and the regional groundwater is useful. The contrast allows the origin of waters flowing through drains to be easily determined in the field. In particular it allows zones of upwelling regional groundwater in the bog to be identified. Furthermore, the contrast allows the relative contribution of either water type to overall flow in a drain to be determined.

5.3.2 Results and Interpretation of Field Hydrochemistry

High electrical conductivities were noted in mA, mC and mD reflecting a regional groundwater contribution to flow in these drains. However, despite the high conductivities, values were lower than anticipated. EC measurements taken in the stream to the north of the site and in similar geological settings elsewhere were up to four times higher than those observed around Crosswood.

The low EC values observed in the marginal drains are believed to be a reflection of the dominance of low conductivity bog water in the drains and the limited input of regional groundwater. The small quantities of groundwater discharging to the drains may be a reflection of the low permeability of the peat substrate.

A consistent drop in EC was observed in mA1 and mD2 along much of their courses. This was believed to reflect the increasing proportion of bog water flowing in the drains.

EC values in mC are similar to those in mA1 and mD2. However the pattern of change in the drains is more irregular. No definite trend can be discerned. The pattern is believed to reflect localised contributions of regional groundwater to flow coupled with more distributed inputs of bog water. No zones of upwelling have been observed away from the drains.

Drains mA2, mB, mD1 and mE to mG contained low conductivity waters derived from the bog.

5.3.3 Laboratory Hydrochemistry

2 x 500ml samples were taken for laboratory analysis. One was taken in a clay drain in the cut-away to the NW (A) and the other in a bog pool on the bog (B).
There are small amounts of all the major ions.

A

Electrical conductivity:	106µS/cm
pH:	6.88
Calcium:	12.82 mg/l Ca
Magnesium:	1.29 mg/l Mg
Total Hardness:	37.32 mg/l CaCO3
Alkalinity:	56.17 mg/l HCO3
Sodium:	6.75 mg/l SO4
Potassium:	0.51 mg/l K
Chloride:	12.25 mg/l Cl
Sulphate:	1.75 mg/l SO4
Aluminium:	185 µg/l Al
Iron:	254 µg/l Fe

B

Electrical conductivity:	67µS/cm
pH:	4.38
Calcium:	1.13 mg/l Ca
Magnesium:	0.8 mg/l Mg
Total Hardness:	6.12 mg/l CaCO3
Alkalinity:	-3.85 mg/l HCO3
Sodium:	6.35 mg/l SO4
Potassium:	0.59 mg/l K
Chloride:	10.5 mg/l Cl
Sulphate:	0.55 mg/l SO4
Aluminium:	81 µg/l Al
Iron:	<50 µg/l Fe

6. VEGETATION

6.1 VEGETATION SUMMARY

There is a well-developed sequence of pools and hollows on the central section of the high bog with a high cover of various *Sphagna* species, including *Sphagnum pulchrum*, to the north-west of the site. A moderate *Sphagnum* cover is seen over approximately 27ha of the bog (26%) and a high *Sphagnum* cover occurs over 18ha (17%). The latter areas are quaking in places.

In the central area there is a flush with *Pinus* species (mainly *Pinus sylvestris*), *Betula* and *Ilex*. There is evidence that some of these were burnt in the past. This vegetation is surrounded by an area which has been burnt in the past and features a lower abundance of *Sphagna* than seen in the central complexes as well as a greater abundance of *Narthecium* and algal hollows. On the lower slopes, *Trichophorum* dominates. There is no face-bank complex seen along the north-east margin where active peat cutting is carried out. There are scattered *Rhododendron* and *Pinus sylvestris* trees encroaching onto the high bog.

Betula and *Ulex* species dominate to the east and south-east on old cut-away peat and to the north beyond the railway line. There is coniferous forestry to the S and SW of the site.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

This is found all around the site except along the north-eastern edge where the slope down to the edge of the bog is dominated by *Molinia*. Here the bog borders on to mineral soil. Complex 1 is also absent at the W of the site in an area of active peat cutting. The typical face bank complex around the rest of the bog is very narrow in extent due to recent peat cutting activities. The face bank complex is also found at the western end of the site between the double drain bF.

Complex 2

This complex of *Trichophorum* clumps with *Narthecium* hollows and erosion channels is found on the lower slopes around the north-eastern edge of the bog (P.L3:22 looking NW). There is evidence of burning (bare patches of peat and *Campylopus introflexus*). Water logging has resulted in a high occurrence of algal pools. *Huperzia selago* was recorded in this complex. The slope to the cut-away is significant at the north-east and south-east of the site and there are deep cracks on the *Calluna* dominated surface. The *Sphagnum* cover is low in this complex and there is generally no acrotelm layer.

Complex 2+ *Molinia* (Mo)

Molinia is the dominant species of this complex with notable amounts of *Trichophorum*. It is found on the north-east of the site near old cut-away. The land to the south, west and north-west of it slopes down to the area suggesting possible water run-off. It may also be associated with the underlying mineral soil as the peat may only form a thin layer in this area. (This area is shown as being on mineral soil on the 1840s sheet.)

Complex 3

This is a complex dominated by *Carex panicea* and *Narthecium* flats or hollows. It is found in the area around the east end of drain bF and at the north of the site. It also shows evidence of burning and there are up to 20% algal hollows. There is a reduction in the amount of *Trichophorum* present. There is a steep slope south of drain bF to the face bank (PL3: 28 looking NNE). At the east side of

the northern edge in the vicinity of the recently dug drains which come down from the high bog, there is much surface water runoff and erosion. The *Sphagnum* cover is generally low and the bog surface is not very soft.

Complex 2/3
At the south of the site where this vegetation complex dominates, many drains which run perpendicular to the central drain have dried the area considerably. The spoil has been deposited on the bog: there is little *Sphagnum* present and the *Calluna* is > 25cm tall. There is up to 30% cover of *Trichophorum* in places with many algal hollows, much *Carex panicea* and *Narthecium* hollows also present. The complex is also found to the west of the site where it slopes down to active facebanks. There is no acrotelm layer associated with this complex.

Sub-Marginal Complex
Complex 6
This is dominated by *Narthecium* hollows and flats. *Sphagnum* cover is improved with up to 10% each of *S. capillifolium, S. papillosum* and *S. magellanicum* hummocks. *Sphagnum imbricatum* was very scarce but was recorded. There are occasional *Leucobryum glaucum* hummocks and *Racomitrium lanuginosum* occurs in small patches. There is evidence of burning (*Campylopus introflexus* and *Cladonia floerkeana* and the overall lichen cover is low). The algal pools are connecting at the outer edges of the complex and are forming erosion channels. There are linear pools present which are aligned in an east/west orientation. Patches of *Carex panicea* also occur.

The vegetation to the north west of the site where 5 new drains extend approximately 150m up on to the bog is of this complex.

Sub-Central Complex
Complex 15
This is found around the southern edge of Complex 15 and is very similar to it except that there is increasing amounts of algae in the pools, the *Sphagnum* cover decreases and the area is not quaking.

Central Complex
Complex 15
This covers a large area to the north-west of the site. It is quite wet and quaking in parts with a total *Sphagnum* cover of 70%. There are well developed pools (30%) (PL3:25) with healthy populations of *Sphagnum cuspidatum* and hummocks with a good *Sphagnum* cover in the inter-pool areas (PL. 3:21 looking east). Both *Sphagnum fuscum* and *S. pulchrum* (PL3:23 and 3:24) were found on the inter-pool lawn areas and on the drier hummocks, *S. imbricatum* and *Leucobryum* were seen. *Sphagnum capillifolium* and *S. magellanicum* cover was 30% on the lower hummocks. Algal and *Narthecium* hollows were still present on this complex.

6.2.2 Flushes
Flush Z
The flush area is found in the mid western section of the bog. It is relatively dry with up to 150 trees growing on it (mainly *Pinus sylvestris*) (PL3:27 and PL3:26). There was also *Betula* scrub and one young *Ilex* tree was seen. The ground cover was dominated by *Eriophorum vaginatum* and tall *Calluna*. Also present were *Vaccinium oxycoccus, Empetrum nigrum, Hypnum jutlandicum, Aulacomnium palustre, Polytrichum commune, Dicranum scoparium, Pleurozium schreberi, Sphagnum capillifolium, S. recurvum* var. *mucronatum* and *S. magellanicum*.

The north side of the flush was wetter and there was greater *Sphagna* cover dominated by *S. magellanicum*.

7. BOG TYPE

This bog has been classified as a Basin bog type.

8. HUMAN IMPACT

8.1 RECENT HUMAN IMPACT (See Landuse Map)

8.1.1 Peat Cutting

Peat cutting, both recent and old has been carried out around most of the site; the south-west has suffered the least though it has been extensively drained (Drain Complex bJ). The older cut-away areas are confined to the south east and north-west of the site. Difco machines are being used at the western end of the site. However, there are many newly deepened drains on the cut-away along the south and south-east of the site and there is severe slumping of the bog near these edges. At the N of the site new drains have been excavated on the high bog (Drains bA-bE) since 1993 when the aerial photograph was taken. To the west, north-west and north of the site there is a deep and wide drain (Drain mA) associated with the peat cutting and runs along the road/track. A section of bog to the north of Drain mH and the road and south of the railway track is drained and parts are cut-away. Drain mH is approximately 2m wide and up to 3m deep in places with up to 1m of flowing water.

8.1.2 Dumping

Dumping is carried out along the road and dead cattle were noted in Drain mB1 at the NW side of the site.

8.1.3 Agricultural Improvements

Agriculture is the dominant activity on the land surrounding the bog. Most of well drained land is used as pasture. No tillage has been noted in the area. Many of the cut-away areas around the bog margins are used as pasture, although the intensity of farming in these areas is low.

8.1.4 Forestry and Woodland

There is a coniferous forestry plantation to the south and south west of the site and this was not evident on the 1970s aerial photograph. Deciduous woodland has been present in this area for some time as a mixed deciduous and coniferous woodland is indicated on the 1910 6" sheet. To the north-west of the site on the far side of the railway line is a copse of *Quercus, Betula* and *Salix* species. *Ulex* is found along both sides of the railway track. Much cut-away peatland has remained unused for a number of years and is now colonised by scrub.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

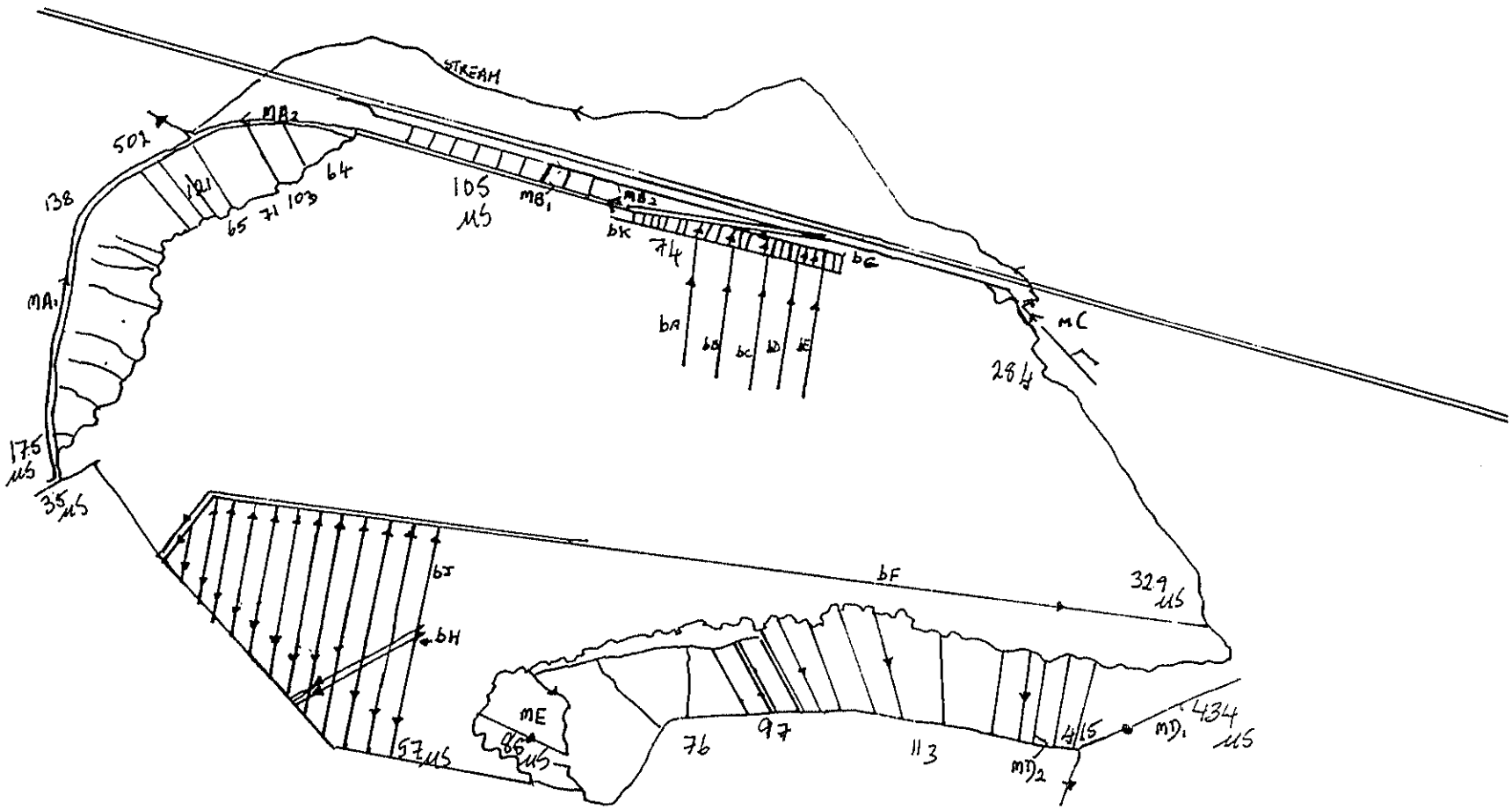
1. Severe slumping of the bog towards the north-east and south-west is seen. This is associated with marginal vegetation communities.

2. The marginal vegetation complexes extend furthest into the site at the east of the site where the high bog is narrowest and where peat cutting has been most extensive.

3. The N/S drains from Drain bF have caused considerable drying out of the bog and have caused changes in vegetation cover. The recent aerial photographs did not indicate the new and even more recent drains bA - bE which are directly draining one of the wettest parts of the bog. These will undoubtedly affect the quality of the central area.

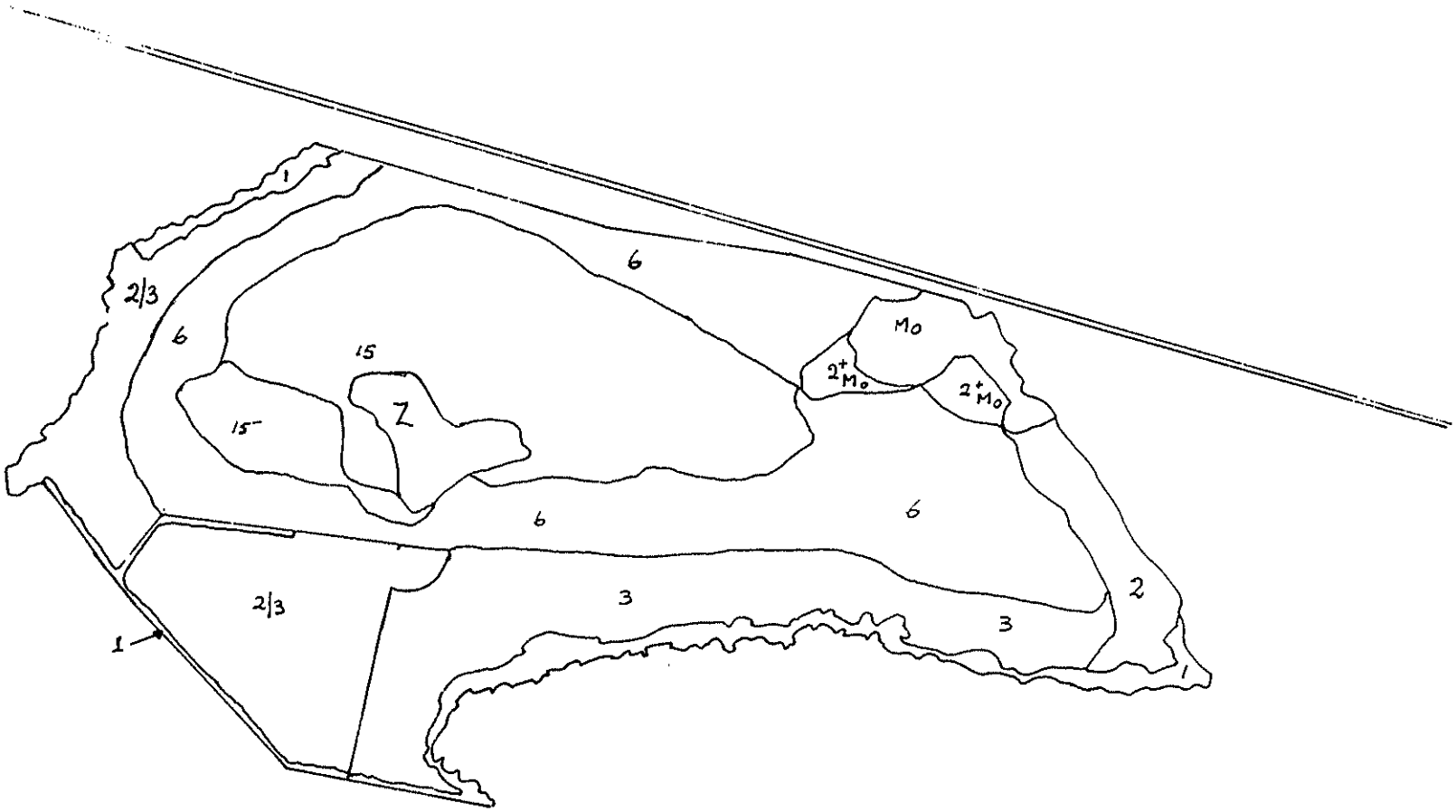
Lara Kelly
Marie Dromey
Malcolm Doak

Raised Bog Restoration Project (1995).



CROSSWOOD BOG, CO. WESTMEATH (678).
DRAINS AND HYDROCHEMISTRY MAP (1:10.560)
1994

N



CROSSWOOD BOG, CO. WESTMEATH (678).
VEGETATION MAP (1:10,560)
1994

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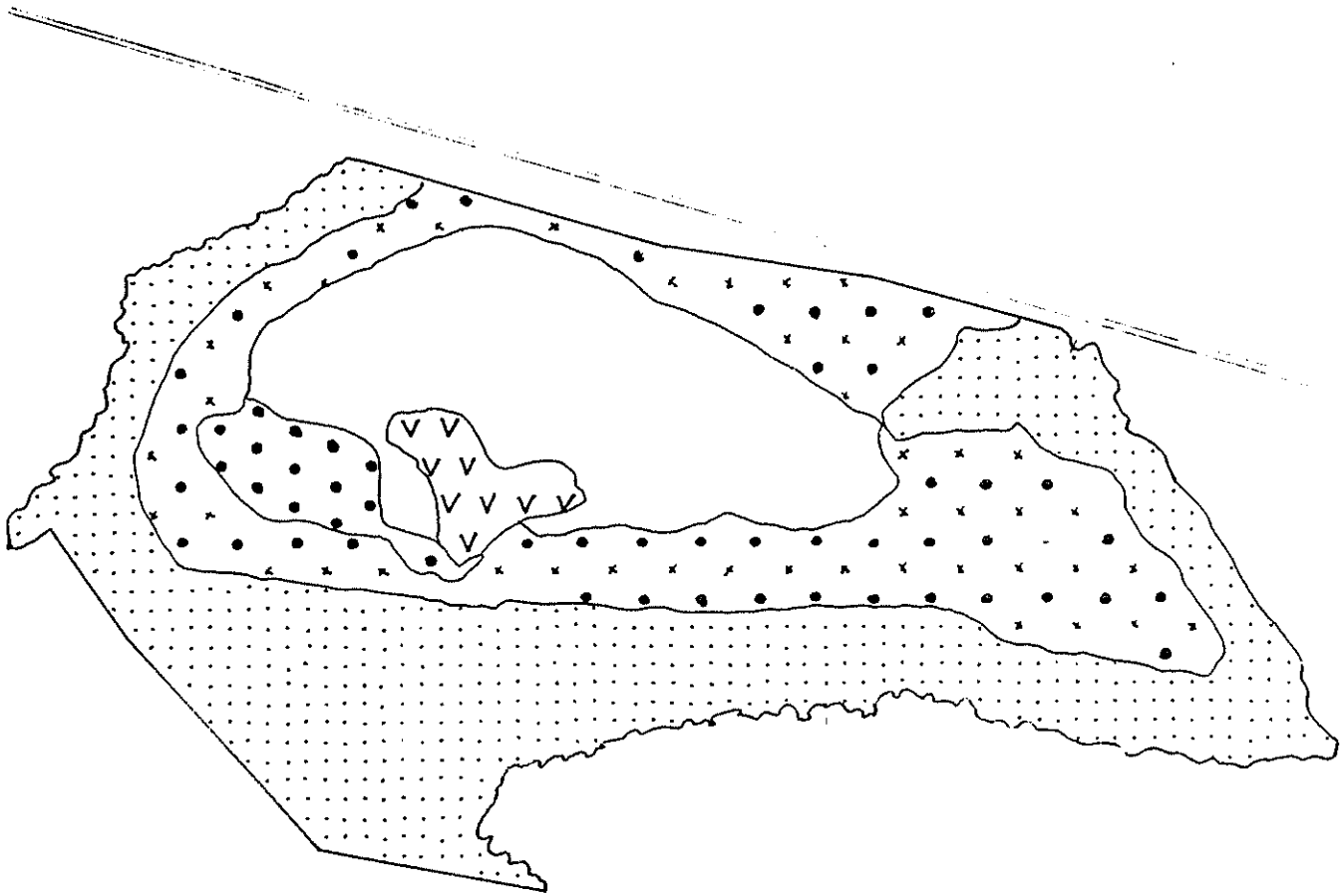
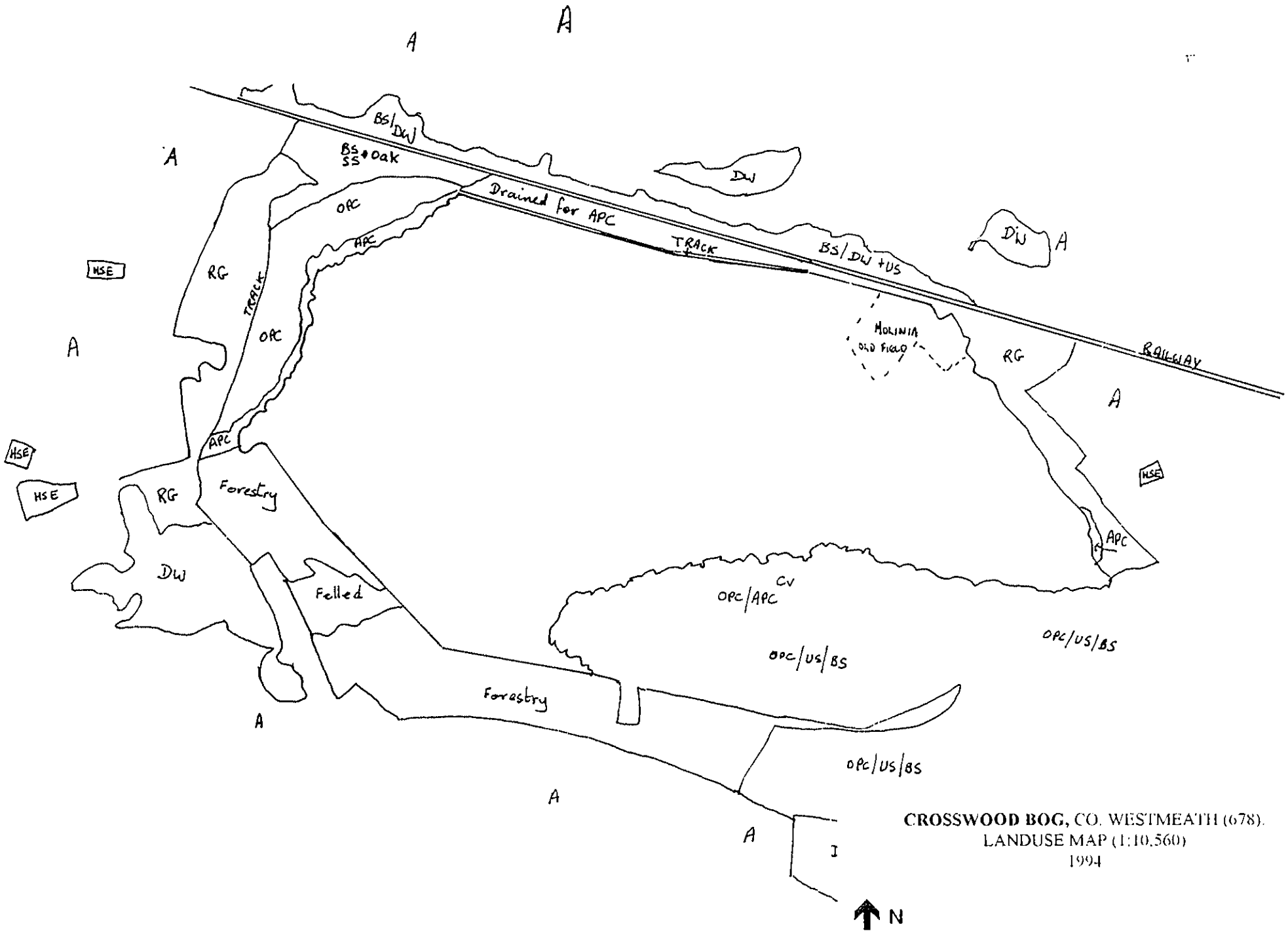


CROSSWOOD BOG, CO. WESTMEATH (678).
ECOTOPE MAP (1:10,560)
1994

N



CROSSWOOD BOG, CO. WESTMEATH (678).
LANDUSE MAP (1:10,560)
1994

CURRAGHLEHANAGH, CO. GALWAY

1. SUMMARY OF SITE DETAILS

NHA No.	256	1/2" Sheet:	12
Grid Ref:	M 68 54	6" Sheet:	GY 32
GSI Aerial Photo:	M211	1:25,000 Sheet:	14/25 SE
Other Photo:	OS 1235 (B+W)	Area (ha):	155.0 (High Bog)
Date(s) of Visit:	23-5-94 (Ecology) 23-5-94 (Geohydrology)	NHA Photo:	646: 17-31

Townlands Curraghlehanagh, Rushestown, Milltown and Newforest.

2. INTRODUCTION

2.1 BACKGROUND

This site was included in the present survey for a number of reasons: it is located in the mid west of the country and is classified as a western raised bog; it is both large and ovoid - features which act positively if restoration is recommended; a comparative study of 1993 (NHA survey photography) and 1970s aerial photography revealed that no new forestry planting had occurred on the high bog although drains associated with new forestry in the cut-away had been inserted along the very W edge of the site and no other new drains had been inserted on the high bog.

Douglas and Mooney (1984) survey the site as part of the National Raised Bog Survey. They found that the site was a large intact raised bog of deep peat with signs of good *Sphagnum* regeneration following a burning event and that there was an area (30% of the site) of wet pools with medium sized hummocks, including those of *S. imbricatum*. The site was assigned an A rating following this Survey (Cross, 1990) which indicates that it was a unique site with a relatively intact hydrology and with extensive wet and quaking areas.

It appears that this large site has not suffered severe damage in the intervening 10 years since it was last surveyed. Furthermore 160 ha are owned by BNM - a positive feature if NPWS are to acquire the land for conservation restoration measures.

2.2 LOCATION AND ACCESS

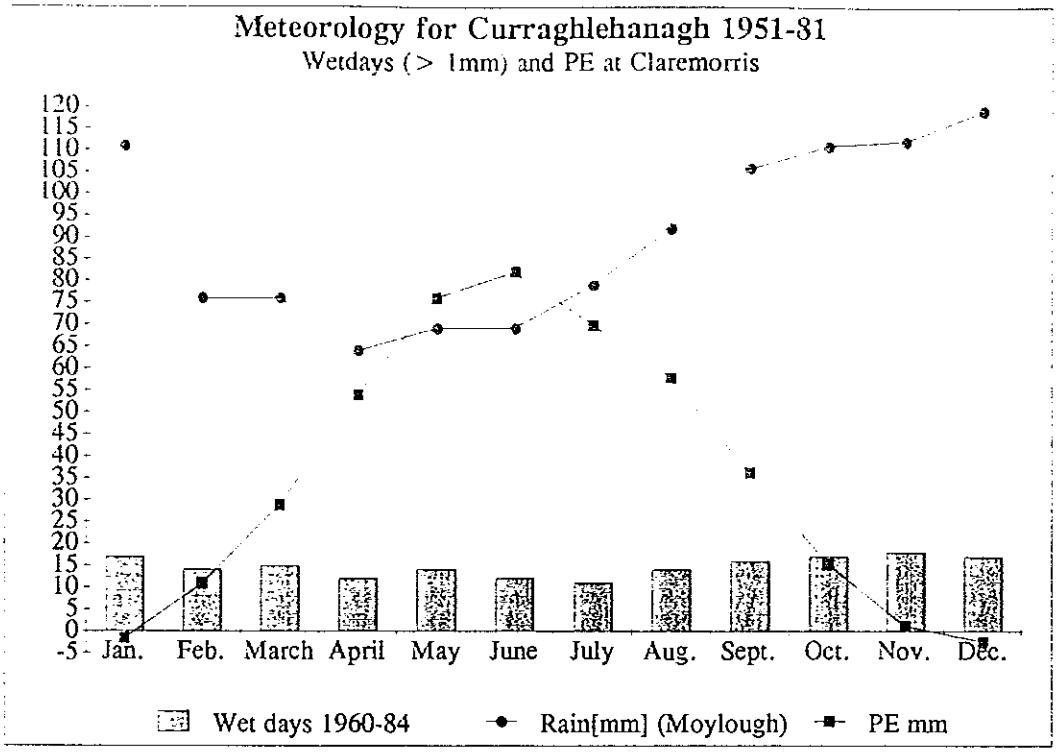
This site is located 6km north of Mount Bellew. It may be accessed from the road which runs to the south via a gravel trackway associated with peat cutting.

3. METEOROLOGY

No meteorological measurements have been made on Curraghlehanagh bog. Rainfall data from the nearby Moylough rainfall station for the years 1951-81 indicate that the area receives approximately 1084mm of precipitation annually (Fig. 14). The nearest Meteorological Service synoptic station at Claremorris suggests that the site could have up to 234 rain days and up to 177 wet days annually.

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

Figure 14:



The above factors suggest that the year round actual evapotranspiration (AE) from Curraghlehanagh bog is greater than PE at Claremorris, site of the nearest synoptic station which had an average PE of 428.1mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Curraghlehanagh would therefore be greater than 428.1mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 656mm/yr.

The meteorological data for Curraghlehanagh Bog (1951-1981) are summarised below:

Precipitation	1084mm/yr
Actual Evapotranspiration, (AE)	>428.1mm/yr
Potential recharge, (PR)	<656 mm/yr
Raindays > 0.2mm (annual {1951-80})	234 days
Wetdays > 1mm (annual {1960-1984})	177 days

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

This site has a typical raised bog topography with a central gentle dome which slopes towards the margins. There are three noticeably depressed areas. One is associated with drain bC at the north of the site where some subsidence has occurred due to increased water loss. The other two are related to small bog bursts on the eastern side of the site.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

This bog lies on a relatively low lying plateau entirely within the upper reaches of the Shiven River. There are only very slight slopes in the area that surround the bog.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

Recent geological maps by Hitzman (Chevron/GSI,1993) show that the area is directly underlain by shallow water bioclastic Carboniferous limestones (shown as SHU, on map). These limestones are pure and susceptible to karstification as is indicated by a swallow hole which occurs 400m to the east of the bog.

The SHU limestones would generally have a moderate to high permeability, depending on their degree of karstification and amount of fissures. These limestones are generally classed as a local moderately productive aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

Data Availability

No subsoils data were available for Carrownagappul Bog apart from the initial 1840s GSI geology field sheets and recent fieldwork carried out for this study.

Geology of Inorganic Subsoils

Silty limestone till is dominant with several clasts of Old Red Sandstone, particularly in the SW. There is an iron pan to the SW, exposed in cut-away drains. Iron Pan is postulated to occur in the east, in the vicinity of the bog bursts.

5.1.3 Depth to Bedrock

Depth to rock on the bog is unknown.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology (See Drains and Hydrochemistry Map)

This site has relatively few drains which extend on to the high bog. Most of the drains are old and marginal.

Drains bA is a complex of six recent drains which extend for the whole length of the W boundary (PL8:11). They are quite possibly associated with forestry. They are approximately 1m wide though some parts of them have collapsed. Collapsing of tbe outer drains into the active cut-away also occurs. Tall *Calluna* grows between the drains. The vegetation of the drains along the middle of their length consists of *Eriophorum angustifolium* and algae. Close to Flush X these drains have more water and support more *E. angustifolium* than the section at Flush Z. There is flow S into Flush Z along these drains. Along their S end the spoil is dominated by *Campylopus introflexus* with some *Polytrichum X.* Further S where only 4 of the six drains remain *Phragmites* grows in the outer (more westerly) three drains. There is significant flow in the most easterly of the drains which then joins with the remaining drains and the water disappears into a crack leading to the bog edge.

Drain bA^1 is seen to the S of Flush Z and at the edge of the bog. It is infilled and supports *S. papillosum, S. cuspidatum, Narthecium* and *Trichophorum.*

Drains bB, like Drains bA, these drains at the NW edge of the bog are also associated with forestry. They are in an area of old cut-away and the drains themselves are old. They are approximately 2m apart and parallel to Drains bA. They show signs that there is flow in them at times of high rainfall. At the time of the survey the drains supported *Carex rostrata, Sphagnum recurvum, Molinia, Potamogeton polygonifolius* and *Eriophorum angustifolium.* There was evidence of iron staining here and also in the facebank drain at the edge of the bog.

Drains bC and bC^1 form a double drain at the N of the site. They run N/S for approximately 300m and are associated with a depression. (PM6:13 looking E across Drain bC showing high ground E of it). They are approximately 10m apart with *Calluna* dominating between them at the N end and *Eriophorum angustifolium* and *Carex panicea* and *Narthecium* further into the bog. *Betula* is also

encroaching at the N end. There are a number of drains 5-10m apart running at a 45 angle into DrainbC[1]. At the SW end Drain bC is 1m wide by 0.5m deep with 15cm of water flowing slowly to the N. At its N end it is 2m deep and 0.75m wide with flow to the N. Drain bC[1] is similar but has more flow.

Drain bD at the N part of the site is old, infilled and difficult to see in the field. It runs NNE/SSW and is dominated by *Calluna* and *Hypnum* with some *E. vaginatum*. The *Calluna* is 40cm tall. At its N end it is colonised by *Narthecium* and *E. vaginatum* and where it crosses into the cut-away is mostly infilled with *Molinia* with some *Juncus effusus, Salix* and *Rubus*.

Drains bE - bG at the N of the site run NNE/SSW and are crossed by Drain bD. They are similar and approximately 0.75m wide by 0.5m deep. They are stagnant at their W end. Drain bE is bare apart from some algae. At its E end there is flow through cracks in the base of the drain into the cut-away. Drain bF also supports *E. angustifolium*. Drain bG is elbow shaped at its W end and is filled with water with dead *S. cuspidatum*. This drain does not quite join bE. There is *Sorbus aucuparia* in the vicinity of Drains bE and bF.

Drain bH runs NNE/SSW, is crossed by Drain bD, is 1.5m wide and is totally infilled *with E. angustifolium, E. vaginatum, Calluna, Myrica* and *Sphagnum cuspidatum, S. magellanicum* and *S. capillifolium*.

Drain bK (mK) at the NNW of the site is parallel to the N end of Drain bD (mD) and is similar to it.

Drain bM and bN at the NE of the site, aligned NNW/SSE, are infilled with *E. vaginatum, S. capillifolium* and *S. magellanicum* with some *Betula* at their N ends. There are some small drains running at right angles from Drain bN to the cut-away. These are also infilled with *Betula*, the most eastern one also supports *Salix, Polytrichum commune* and *S. palustre*. One of these short drains has significant flow N to the bog edge.

Drains bO[1] are a series of very narrow, sballow turbary drains (Fig. X) which are not easily seen in the field and are infilled with *S. cuspidatum* and *E. angustifolium*. They extend into the cut-away at the E of the bog but some extend to drain bO.

Drain bO which runs across the site from NE to S follows a townland boundary. For the first 400m approximately, at its N end, it is a double drain 2m deep by 1m wide with considerable flow to the N. Further into the high bog they narrow into 1m by 1m and are colonised by *Eriophorum angustifolium*. Facebank complex dominates between the drains. Where the drain angles to the S it becomes single and is 1.5m wide with 25cm of stagnant water. The central section E of Drain bP is 1.75m wide with 15cm of water flowing to the SW. *S. cuspidatum* and *Eriophorum angustifolium* colonise in this area. At the S end Drain bO is on a steep slope and is overgrown with *Narthecium* and *S. cuspidatum*. There is evidence of strong flow but this is not seen at the time of the survey.

Drain bP which runs NW/SE in the S of the site leading from Drain bP is 1m wide and very shallow. It is infilled with *S. cuspidatum, E. angustifolium*. This drain runs through an area of undulating bog surface and is associated with cracking of the surface and erosion channels. These erosion channels carry surface water into and out of the drain towards the bog edge. Where this drain is crossed at its SE end by Drain bQ it contains 15cm of water but there is no flow.

Drain bQ runs NNE/SSW at the end of Drain bP. It is overhung by *Calluna* and contains *Salix, Narthecium, E. angustifolium* and *Potamogeton polygonifolius*. The drain is located in a depression and erosion channels run into it from the high bog.

5.2.2 Bog Margin Hydrology with Face Bank Details (See Drains and Hydrochemistry Map)

West

Drains mA associated with hopper-cutting, alongside the track lie in silty/sandy till. Drains are 1m deep and faces 2m high with some slumping. Moving north the faces are older and drains in the cut-away are infilled. Forestry to the NW obliterates faces here.

Drains mA to the south-west intercept till with iron pan.

South-West/South
There are very old face banks to the south where little cutting is practised; faces are a maximum of 1m high and have subsided to a maximum. There are no drains apparent in the cut-away which is overgrown.

East
There are incidents of slumping and bog bursts at the faces, some pre 1970s since the slumps are now overgrown by trees. The bog bursts at Z originate from quite far into the centre of the bog. Generally the area is rather dry with lack of surface drains, although there has been extensive burning in the past.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry ((See Drains and Hydrochemistry Map)
Water flowing from the bog and the adjacent inorganic subsoil was sampled on the 23rd May 1994.

West
Groundwater upwells in drains mA to the W of this bog with ECs of 336 µS/cm and shows of iron. Groundwater also upwells at the faces where water temperature was 10°C. Moving north the ECs become lower since the cut-away drains do not intercept water-table. ECs in drains to the south-west are low ~90µS/cm within the vicinity of the iron pan.

South-West/South
There are low ECs in this area, no upwelling groundwater.

East
There are low ECs in this area, no upwelling groundwater.

5.3.2 Laboratory Hydrochemistry
No samples were taken for analysis at the Coillte laboratory.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
This bog is situated on the side of a drumlin filled valley and originally formed in an interdrumlin depression.

Subsoils are moderate permeability (k), but there is a probability of an Iron Pan at depth. Recent geological maps show that the area is directly underlain by high permeability pure Carboniferous limestones.

Bog Regime
Generally ECs are in the range of 95 - 190 µS/cm, indicating no major incidences of groundwater discharge around the bog edges. EC values were higher at the bog edges in areas of hopper-cutting where drains would have intercepted the water-table. Most of the runoff water from the bog is believed to recharge the relatively permeable till and infiltrate to the watertable as recharge.

Inter-relationship of topography hydrology and hydrogeology
As a whole the bog is located on a plateau which acts as a recharge zone to the surrounding rivers.

All sides of the bog have been cut-away and so lagg zone potential is zero.

6. VEGETATION

6.1 VEGETATION SUMMARY

The vegetation of this site is characterised by a central wet area with linear *Sphagnum cuspidatum* and *Menyanthes* pools and lawns. The remainder of the site is mainly covered by *Carex panicea* dominated complexes with *Narthecium* hollows, *Eriophorum vaginatum* and *Trichophorum* tussocks also of importance.

Two bog burst areas are seen on the eastern side of the site. A high percentage of tear pools, both algal and *S. cuspidatum* filled are associated with these two areas. A number of *Molinia* and *Phragmites* flushes are seen at the edges of the high bog associated with drainage features.

Burning has occurred in the past at this site but very recent burning was only seen in the vicinity of Bog Burst T (RB).

The western indicators *Campylopus atrovirens, Racomitrium* and *Pleurozia purpurea* appear to occur more frequently on the windward side of the site.

In areas of abandoned cut-away *Ulex, Molinia* and *Betula* were common. However in the south and NE (north of Drain mO), *Sphagnum* regeneration was good in old cut-away sections. This is mainly *Sphagnum papillosum* with some *S. capillifolium* and *S. cuspidatum* in the wetter areas. Other bryophytes such as *Aulacomnium palustre, Polytrichum commune, Pleurozium schreberi, Hylocomium* and *Rhytidiadelphus squarrosus* were also seen. Other species noted were *Molinia, Juncus effusus, E. angustifolium, E. vaginatum, Rumex sp. Ulex, Rubus, Calluna* and *Andromeda* (PL8:17-19 and PM6:19-24 between slopes 15 and 17; PM6:15 N of Drain mO). There is no evidence for upwelling in SW regenerating cut-away, as EC measurements were low 72 µS/cm. It appears from the aerial photography of the 1970s that the area in the SW between slopes 16 and 17 was dominated by *Molinia* whereas now they are dominated by *E. vaginatum* and *Juncus effusus*. Where good *Sphagnum* regeneration is taking place the face bank edges are low and grade gently into the old cut area. In contrast close to slope 13 the face bank is 3m tall where active peat cutting is occurring.

South of Drain bP in the cut-away there is an area of mesotrophic vegetation (EC 103 µS/cm). *Typha, Menyanthes, Potamogeton polygonifolius, Potentilla palustris, Carex diandra* and *C. nigra* were seen.

At the NE of the site there is an area of mixed woodland in the cut-away next to the high bog. This contains species such as *Betula, Sorbus aucuparia, Quercus, Pinus sylvestris, Ulex, Pteridium* and *Rubus*.

6.2 DETAILED VEGETATION

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

This complex dominated by *Calluna* is mainly seen at the southern edges of the site where peat cutting is no longer active. It is also found along the Complex of Drain bA and extending for approximately 200m along Drains bC and bO. It is also seen at the extreme N of the site with the addition of *Myrica gale*.

Complex 2.6
This covers a small area to the extreme SE of the bog. *Trichophorum* dominates with *Narthecium*. The area has suffered disturbance due to peat cutting. The *Sphagnum* cover is low and the ground hard underfoot.

Complex 3.2
This is a marginal complex which is dominated by *Carex panicea* and *Trichophorum* with linear algal hollows.

Complex 3.2.4
This complex is also dominated by *Carex panicea* and *Trichophorum* but with significant amounts of *R. alba*. The latter dominates erosion channels which can be up to 30m long. These carry water off the bog. The terrain is rough with tussocks of *Trichophorum* and *Calluna* frequent. The *Sphagnum* cover is low and the bog surface is hard. It is seen at the SE of the site.

Complex 3/2/6
This complex covers a large portion of the site particularly on the eastern side. It is dominated by *Carex panicea* (20%), *Trichophorum* (15%) and *Narthecium* (15%) with 25% algal hollows. Occasionally small hollows of *R. alba* and *S. cuspidatum* are seen. The algal hollows are mainly small and shallow and do not correspond to tear pools. The *Sphagnum* cover is low 10%, mainly *S. magellanicum* and *S. papillosum* (5% each) and there are no large *Sphagnum* hummocks. There is no lichen cover and the *Calluna* is short (10cm). At the SE of the site this complex has less *Narthecium* with lots of erosion channels and surface water run-off. At the S north of the new forestry in the cut-away there are a lot of erosion channels in this complex. In one area SE of Drain bC the *Calluna* cover is very low (3/2/6-).

Complex 6/3
There are small patches of this marginal complex to the W, NW and S of the site. It is found in association with drainage caused by Drains bA, bD, bD, bE and bG and to the SW it is occurrence corresponds with areas of old peat cutting. There is an abundance of *E. vaginatum* tussocks in this complex near Drains bD and bA while between Drains bE and bG there are very large *S. imbricatum* and *S. fuscum* hummocks. To the SW algal hollows are common with *Calluna* hummocks (20 -30cm tall)

Complex 3
This is seen in the marginal areas over all of the site. It is dominated by *Carex panicea* (40%) with an abundance of *Eriophorum angustifolium* at 20%. *Sphagnum* cover is moderate (20%) dominated by *S. capillifolium* (10%) with some *S. papillosum, S. magellanicum* and *S. subnitens*. However there is a high frequency of algal hollows (10%) and there is generally no acrotelm present. The *Calluna* cover is low (5% typical hummocks) and it is short - 20cm. The structure is very poor with the micro topography within the 0-10cm category (PM6:9). In the NE corner E of Drain bC this complex has a high *Cladonia* cover at 80%. It is not considered as Complex 3+ *Cladonia* as the *Sphagnum* cover is much lower and the typical hummock cover is also low. *Racomitrium* was recorded in this complex at the SW of the site in the vicinity of slope 13 and *Huperzia selago* was recorded close to slope 16.

Complex 3-
This is a small area at the NW of the site and associated with Drain complex bA. The presence of algal hollows increases to 30% with a lot of surface water inter-connecting them. There is also an increase in *Trichophorum* (10%) with some *Campylopus introflexus* and *C. paradoxus*. *Sphagnum* cover has decreased to only 5%. At the SE of the site there is a restricted area of this complex with algal pools and tear pools with some *S. cuspidatum*. *S. imbricatum* was also noted.

Sub-Marginal Complexes
Complex 3/6 with Tear Pools (TP).
This is a small area associated with bog burst T. It has 20% pools which are aligned NE/SW. 10% of which are algal and 10% *S. cuspidatum* dominated. *Utricularia, E. angustifolium, Drosera anglica* and *S. auriculatum* were also present. The total *Sphagnum* cover is 20%, most of which

occurs as lawns around the pools and consists of *S. papillosum* and *S. capillifolium*. *Narthecium* hollows and *Carex panicea* flats are common (15% each) with *Trichophorum* at 10%. An acrotelm layer is present in places but is very variable. *Campylopus atrovirens* and *C. paradoxus* were noted.

Complex 3+
This is mainly seen at the NW of the site with a small area to the SW. The lichen cover is high (40%) and the *Sphagnum* cover is good (35%), 20% of which is *S. capillifolium* hummocks and 5% for both *S. magellanicum* and *S. papillosum*. *S. imbricatum* and *S. fuscum* were both recorded and *Racomitrium* was noted in the SW. The *Calluna* on the hummocks reaches 40cm in height. The *Carex panicea* cover is lower (15%) than in Complex 3 but it is still widely distributed. *Narthecium* and algal hollows are common (10% each). (PM6:10 to SW and PM6:11 large *S. magellanicum* hummock). Where this complex occurs in the SW, there were two *Molinia* dominated mounds which appeared to be in a line between Slope 16 and Flush Z. These may indicate an area through which water flows as there is a slope to the NW into the flush. Other species on the mounds included *Calluna, Vaccinium oxycoccus, Andromeda, Pleurozium schreberi, Polytrichum alpestre, Hypnum, Hylocomium, Sphagnum capillifolium, S. subnitens* and *S. tenellum*. There was 50% *Cladonia portentosa* cover.

Complex 3 +Tear Pools (TP).
This is a sub-marginal complex which is associated with drainage or slumping of the bog. It occurs at the SW of Drain bC and around the bog burst T. It is dominated by typical hummocks (40%) and *Carex panicea* (15%) with 10% cover of both *Trichophorum* tussocks and *Narthecium* hollows. The *Sphagnum* cover is moderate (25%), 15% of which is hummocks. Occasional hummocks of *S. imbricatum* and *S. fuscum* are seen. The algal tear pool cover is high (25%) in the vicinity of Drain bC. These are aligned SW/NE and have some *S. papillosum* and *S. magellanicum* lawns. North of Drain bO the pools are large and are mainly filled with *Sphagnum cuspidatum* and *Menyanthes* with *Rhynchospora alba* flats between them. This is also the case around bog burst T, where the pools are large and aligned SW/NE and are infilled with *S. cuspidatum* and *Menyanthes* with the addition of *Drosera anglica* and *S. auriculatum*.

Sub-Central Complex
Complex 3/10
This complex is seen at the SW of the site between complexes 3 and 4/15. It has a high *Sphagnum* cover (50%), 40% hummocks. These are composed of 10% *S. capillifolium*, 25% *S. papillosum* and 5% *S. magellanicum*. *Carex panicea* accounts for 10% with 5% for both *Narthecium* and algal hollows. There are no pools and the acrotelm layer is variable. There is very little *Cladonia* cover and the *Calluna* is very low. This is probably due to a burning history

An area of this complex with a high *Cladonia* cover is indicated by 3/10+Cl. Within this complex some *S. imbricatum* and *S. fuscum* were recorded. Large hummocks (2.5m diameter and 0.75m high) supported *Leucobryum, Rhytidiadelphus, Hypnum, Hylocomium, Polytrichum alpestre, Dicranum, Sphagnum capillifolium, S. tenellum, Andromeda, Calluna* and, on one, *Rubus*.

Central Complex
Complex 4/15
This is the wettest complex of this bog. It covers approximately 30ha in the centre. *Sphagnum cuspidatum* pools are common (25%) with a total *Sphagnum* cover of 40%, 30% of which is in lawns/pools (PM6:16 and 17). The pools, which are mainly aligned NNE/SSW, also contain *Menyanthes, S. auriculatum, Drosera anglica* and *Utricularia*. There is 10% *S. papillosum* and 10% *S. magellanicum* hollows. *R. alba* lawns are frequent in the inter-pool areas (20%). *Trichophorum* (10%), algal hollows (10%) and *Narthecium* (5%) make up most of the remaining cover. The typical hummock cover is low (10%). An acrotelm is present but is variable. *S. imbricatum* and *S. fuscum* occur with some large hummocks of *Racomitrium* (PM6:18). *Pleurozia purpurea* was also recorded and *Campylopus atrovirens* was commonly seen around the edges of the pools. There was an area of this complex which has not been burnt for some time (Complex $4/15^{+}$). This is indicated by the high cover of *Cladonia portentosa* with taller hummocks of *Calluna* and a higher occurrence of *S. imbricatum* with a higher *Sphagnum* cover in the inter-pool areas. Some tall

S. capillifolium hummocks were seen (30cm). *Aulacomnium palustre* was seen surrounding some pools. Flow was noticed in some inter-pool areas between adjacent pools.

6.2.2 Flushes

There are some small *Molinia* dominated flushes at the W edge of the bog which are associated with drainage and one to the NE. Two other interesting and unusual features which are slightly flushed occur to the E of the site and appear to be localised bog bursts. These bog bursts occurred some time before the 1970s (as the features are visible on the 1970s aerial photograph) and the peat in the cut-away has been colonised , mainly by *Betula*.

Flush Z

This linear feature approximately 2m wide is located on the S side of the western edge of the bog. It is dominated by *Molinia* and *Phragmites* with the *Phragmites* extending further on to the high bog to both S and E. The area was quite wet underfoot but no flowing water was seen. At the head of the flush dead, burnt *Betula* was seen with many small *Betula* seedlings surrounding it. *Pinus contorta* was also seen. Other species recorded included *E. vaginatum, E angustifolium, Calluna, Succisa pratensis, Polygala vulgaris, Potentilla erecta, Andromeda* and *Menyanthes*. The bryophyte layer is dominated by *S. capillifolium* with *S. palustre, S. magellanicum, S. papillosum, S. subnitens* and *Leucobryum*.

Flush Y

Slightly N of Flush Z this dry flush has a high *Sphagnum* cover (70%) mainly *S. capillifolium* with some *Aulacomnium palustre* and *Polytrichum alpestre*. *Phragmites, Betula* and *Pinus* occur in the high bog in this area with some *Pedicularis sylvatica* on the eastern side.

Flush X

This is further N along the W edge and is associated with a depression and sloping ground on three sides (PL8:10 to NW). It contains *Betula, Juncus effusus, E. angustifolium, E. vaginatum, Polytrichum alpestre, Andromeda* and *Calluna* up to 50cm tall. A swallow hole was noted to the east of the area where Drain complex bA run through the flush.

Flush W

This is located at the NW side of the site where forestry is seen on the high bog. It extends out into a fire break in the forestry. The flush is dominated by *Molinia* with *Phragmites* at the edge extending approximately 30m into the flush. Other species recorded included *Sorbus aucuparia, Polygala vulgaris, Potentilla erecta, Hylocomium splendens* with *Alnus, Vaccinium myrtillus, Dryopteris* and *E. vaginatum* next to the forestry. An unusual feature of this flush was the tall *S. capillifolium* hummocks up to 1m in height. The *Calluna* was also tall at approximately 80cm.

Flush V

This is located at the NE side of the site. It is relatively dry and dominated by *Molinia* and *Phragmites* with *Polygala, Potentilla erecta, Erica tetralix, Andromeda, E. vaginatum, Calluna* 20-30cm tall and *S. capillifolium* hummocks. Some *Campylopus introflexus* was seen on dry tussocks and occasional clumps of *Betula*.

Bog Burst U

This, the smaller of two bog bursts, is located to the SE of the site in an area where severe slumping and flow of peat has occurred resulting in long curvilinear tear pools. These tear pools are mainly infilled with *S. cuspidatum*, and algae with *E. angustifolium* and are up to 20m long in places.

Bog Burst T

This larger bog burst has also resulted from slumping and peat flow and is clearly visible from the aerial photography. The face bank edge is very low as the peat has flowed out into the cut-away. Tear pools on the S side are aligned SW/NE and are infilled with *S. cuspidatum* and *E. angustifolium*, some *S. auriculatum* and *Drosera anglica*. At the edges of the pools *S. papillosum* lawns occur and *Campylopus atrovirens* is also seen (PL8:25 to S). Further into the centre of the bog burst there are a number of bare erosion channels with very rapid water flow to the east (PL8: 26 and 27). This flow disappears underground in places. There is also a main channel running

through the centre of the depression with a very wet quaking area at its eastern end. This is dominated by *S. cuspidatum* and *S. auriculatum* lawns with *Menyanthes, Utricularia, Drosera anglica, Juncus effusus* and *Molinia* (PL8:28 and PM6:36). Some hummocks with *Calluna, Vaccinium myrtillus, Pteridium* and *Aulacomnium palustre* occur in the area. To the W the *Sphagnum* lawns also support *Potamogeton polygonifolius* with *Menyanthes* and *Aulacomnium palustre. Pleurozia purpurea* was seen in the vicinity. A section of the SE edge of the flush was recently burnt (PM6:35 to N along E edge).

7. BOG TYPE

This bog has been classified as a Basin bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes

Marginal slopes were estimated in the field at the time of the survey. The locations of the slopes are shown on the Slopes Map.

Slope 1 — At the western side of the site, N of flush Z the slope is 0.5m over 40m into active cut-away and is associated with cracking and slumping of the peat surface.

Slope 2 — North of slope 1, the slope northwards into flush X is steep, 1m over 50m.

Slope 3 — A slope to the W in the same area is 0.5m over 30m.

Slope 4 — At the NW of the site into old cut-away between the forestry and the high bog the slope is 1m over 40m.

Slope 5 — At the northern part of the site in association with the depression caused by Drain bC the slope from the W into it is 0.25 over 50m.

Slope 6 — At the NW of the site leading from Flush W, NW into the forestry, the slope is 1m over 50m.

Slope 7 — At the N point of the site from the high bog northwards into forestry the slope is 1m over 75m.

Slope 8 — At the N of the site the slope from high bog, between Drains bF and bE, into active cut-away is 0.5m over 15m.

Slope 9 — At the NE side of the site S of Flush V the slope into active cut-away is 0.5m over 10m.

Slope 10 — At the E side of the site into active cut-away the slope is 1m over 50m with severe cracking and slumping of the peat surface.

Slope 11 — Also at the E of the site and in association with Bog Burst U the slope is quite steep at 2m over 100m with extreme cracking and slumping of the bog surface.

Slope 12 — At the W side of the site S of Flush Z into active cut-away the slope is initially 0.5m over 30m but if taken over a greater distance is 1m over 100m. There is associated cracking and slumping.

Slope 13 — At the SW corner of the site into active cut-away the slope is 1m over 50m with severe cracking of the bog surface. Associated with this slope is a facebank 3m tall with marginal Drain mA cutting into the underlying till.

Slope 14 — To the E of Slope 13, into active cut-away, the slope is 0.5m over 20m. Here the facebank is very shallow.

Slope 15 — In the SW corner of the site into old cut-away the slope is 0.75m over 40m with severe older cracks and slumping (PM6:26). Many of these cracks are now infilled with *Sphagnum*.

Slope 16 — In the SW corner of the site but sloping to the NW. The slope into old cut-away is 0.75m over 40m.

Slope 17 — This is at the SW of the site into active cut-away. The slope is 0.5m over 30m. The facebank here is 2m tall and there is severe cracking and slumping of the bog surface.

Slope 18 This is also at the S of the site into old cut-away (PM6:26). The slope is 1m over 50m with many erosion channels and surface water run-off.

Slope19 AT the SE corner a large part of the bog slopes to the S. The slope to the S into old peat cutting is 0.75m over 50m and there is severe old cracking and slumping at the bog edge.

Slope 20 At the SE corner of the site the slope is 0.25m over 40m into old cut-away, where the face bank is very shallow, 0.5 metres or less (PM6:31 to NNE). There is some old cracking on the peat surface associated with this slope.

Slope 21 At the E of the site looking N into the main channel of Bog Burst T in the centre of the depression the slope is 0.75m over 100m.

Slope 22 From the western side of the Bog Burst U to the eastern bog edge, the slope is 1m over 300m.

8.2 RECENT HUMAN IMPACT (See Landuse Map)

8.2.1 Peat Cutting

At present peat cutting is being carried out, using mainly the hopper method of extraction, at the mid western, north-eastern (PL8:12 looking E, PM6:12 and 14, N into hopper cutting) and eastern sides of the site. There are some minor active peat banks to the south, including those behind the regenerating cut-away which are being cut using the difco method (PM6:26-27). Along the southern side of the bog many of the abandoned cuttings have good *Sphagnum* regeneration (PL8: 17-19).

8.2.2 Forestry

A coniferous forestry plantation, mainly *Pinus contorta* with some *Picea sitchensis*, grows along the western and northern edges of the bog. Part of the northern forestry is planted on high bog peat with no cut-away between the high bog and the start of the forestry. There is also a small more recent plantation in old cut-away to the south (PL8:20 and 21).

8.2.3 Cattle Poaching

At the S of the site where face banks are low and adjoin pasture there are indications that cattle gain access onto the high bog.

8.2.4 Fire History

An area of vegetation at the eastern side of the bog in the region of Bog Burst T had been recently burnt. There were no other areas of recent burning noted. Parts of the site had not been burnt for some time, indicated by a high *Cladonia portentosa* cover. Theses were seen to the north and south of the site.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. The bog bursts at the E of the site are associated with slippage of lower peat layers. They are increasing water loss from the site and thus causing drying out.

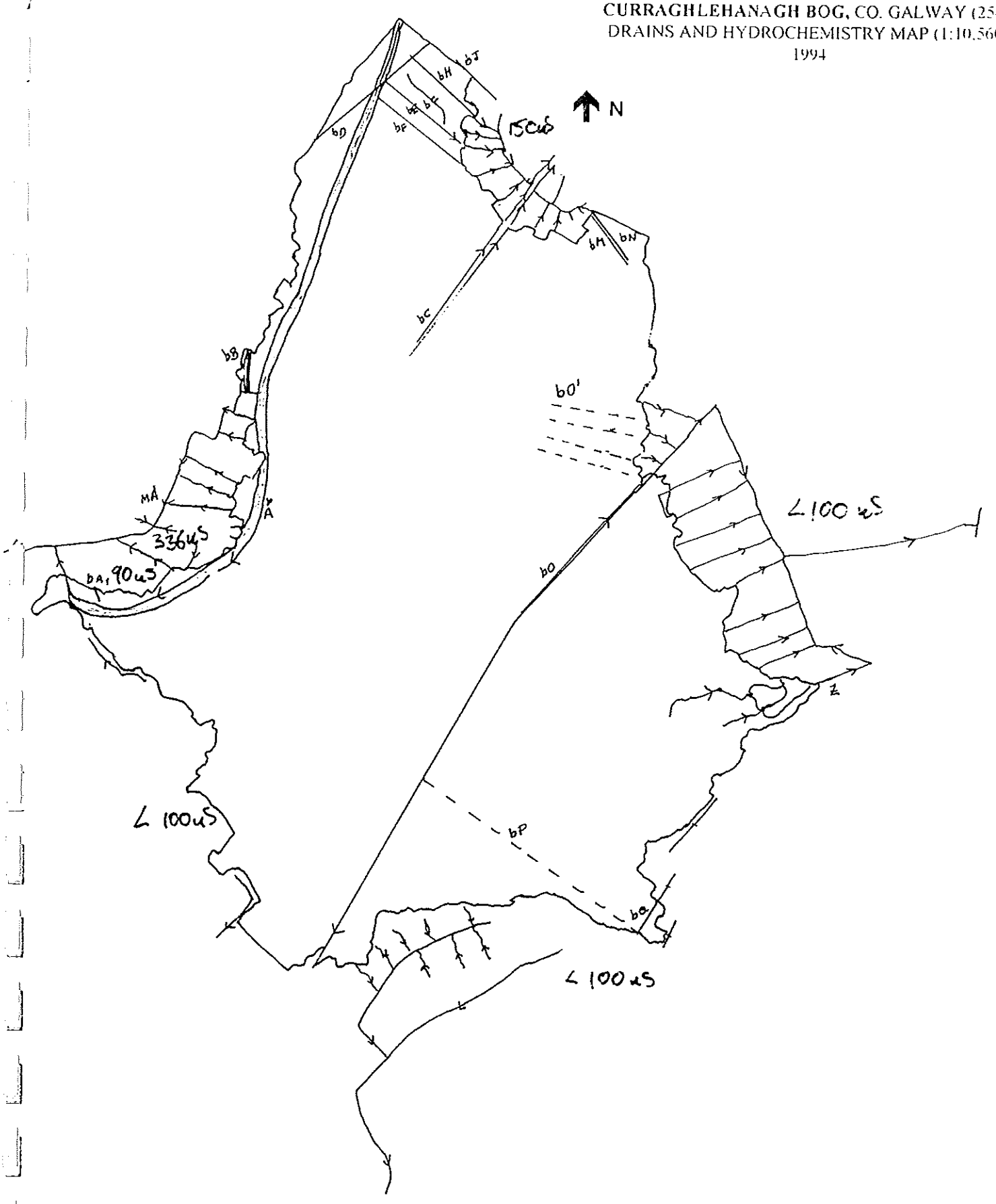
2. The central wet area that remains is situated on the flattest section of the site.

3. Tear pools at the N of the site are associated with subsidence caused by drainage.

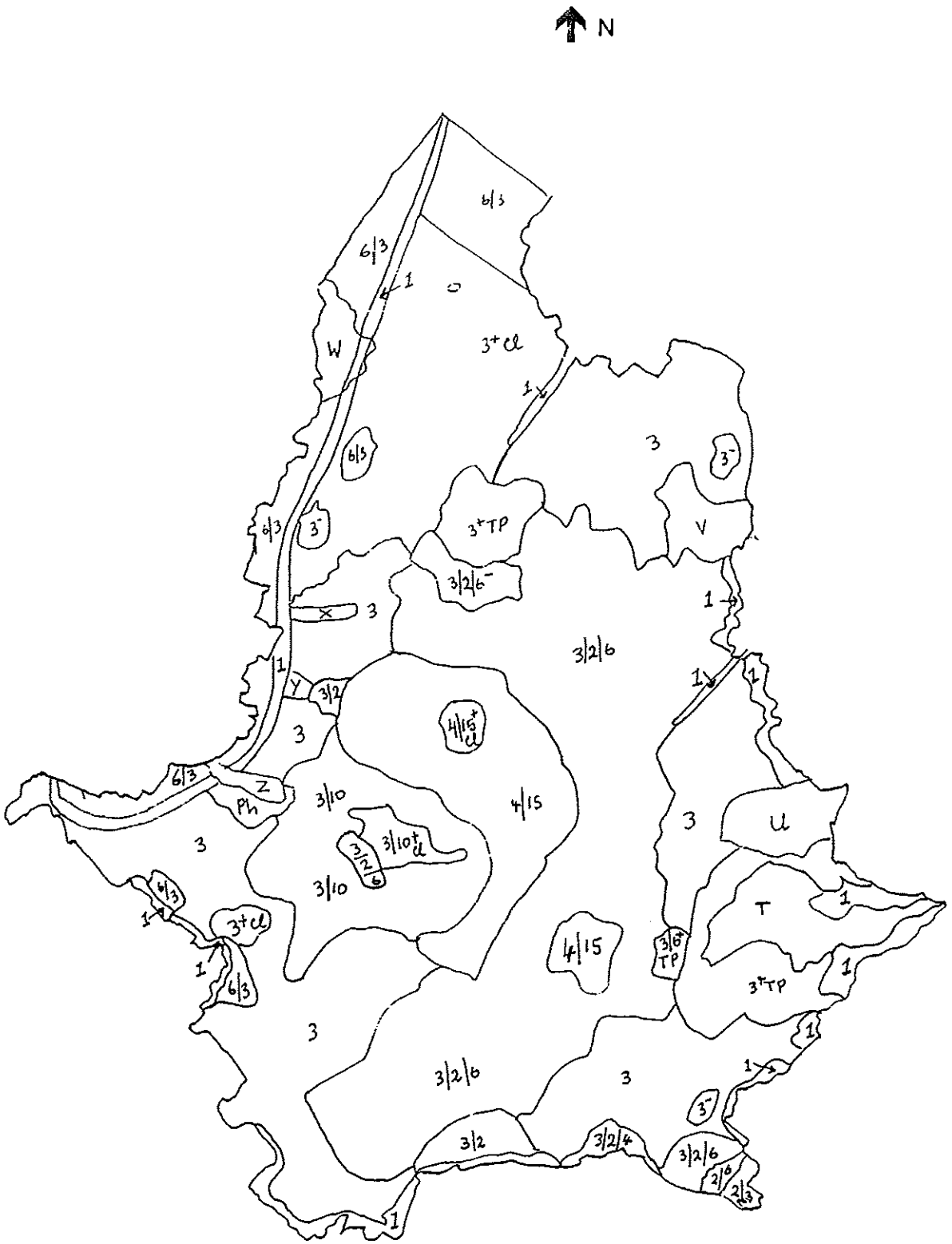
Lara Kelly
Marie Dromey
Malcolm Doak

Raised Bog Restoration Project (1995).

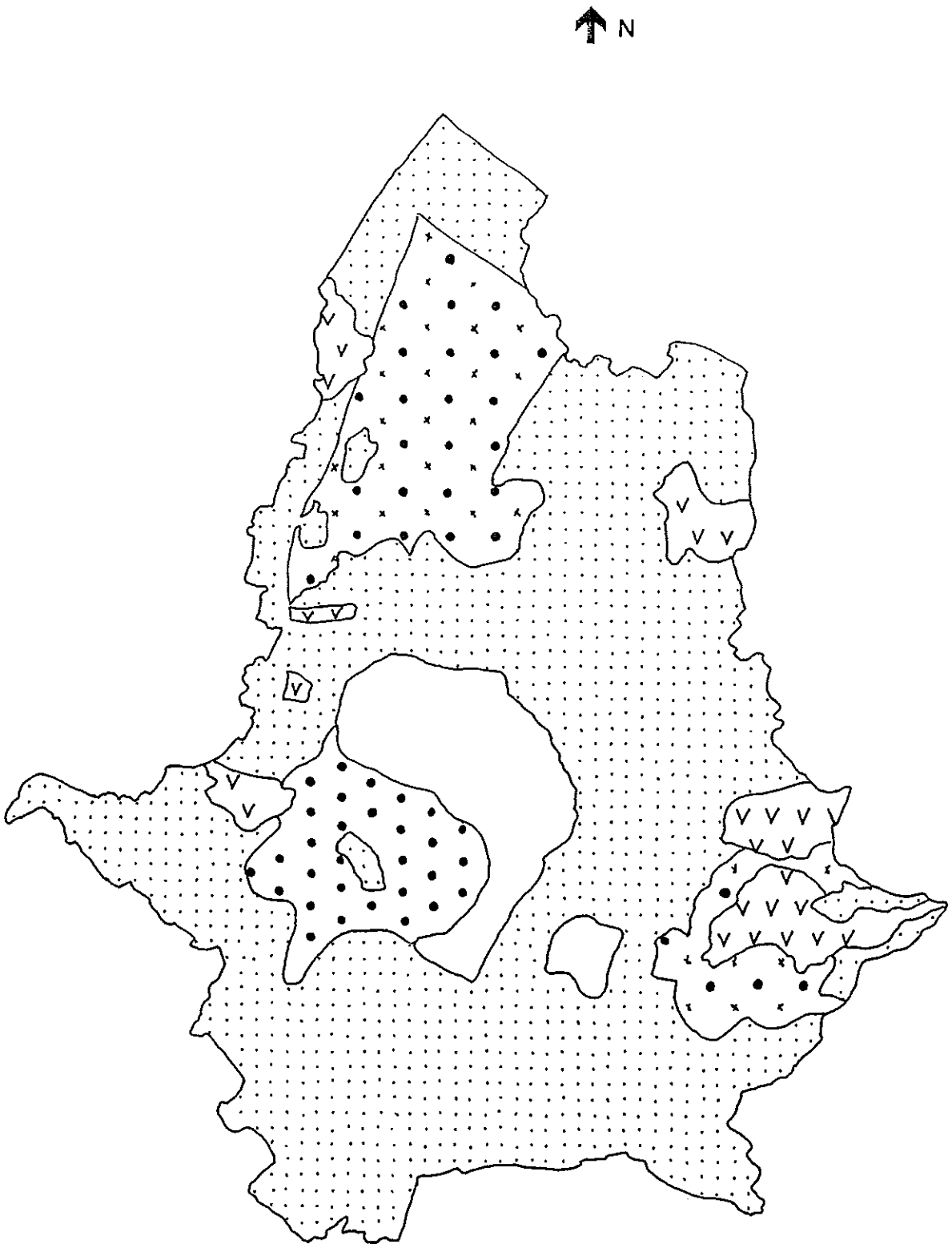
CURRAGHLEHANAGH BOG, CO. GALWAY (256)
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994



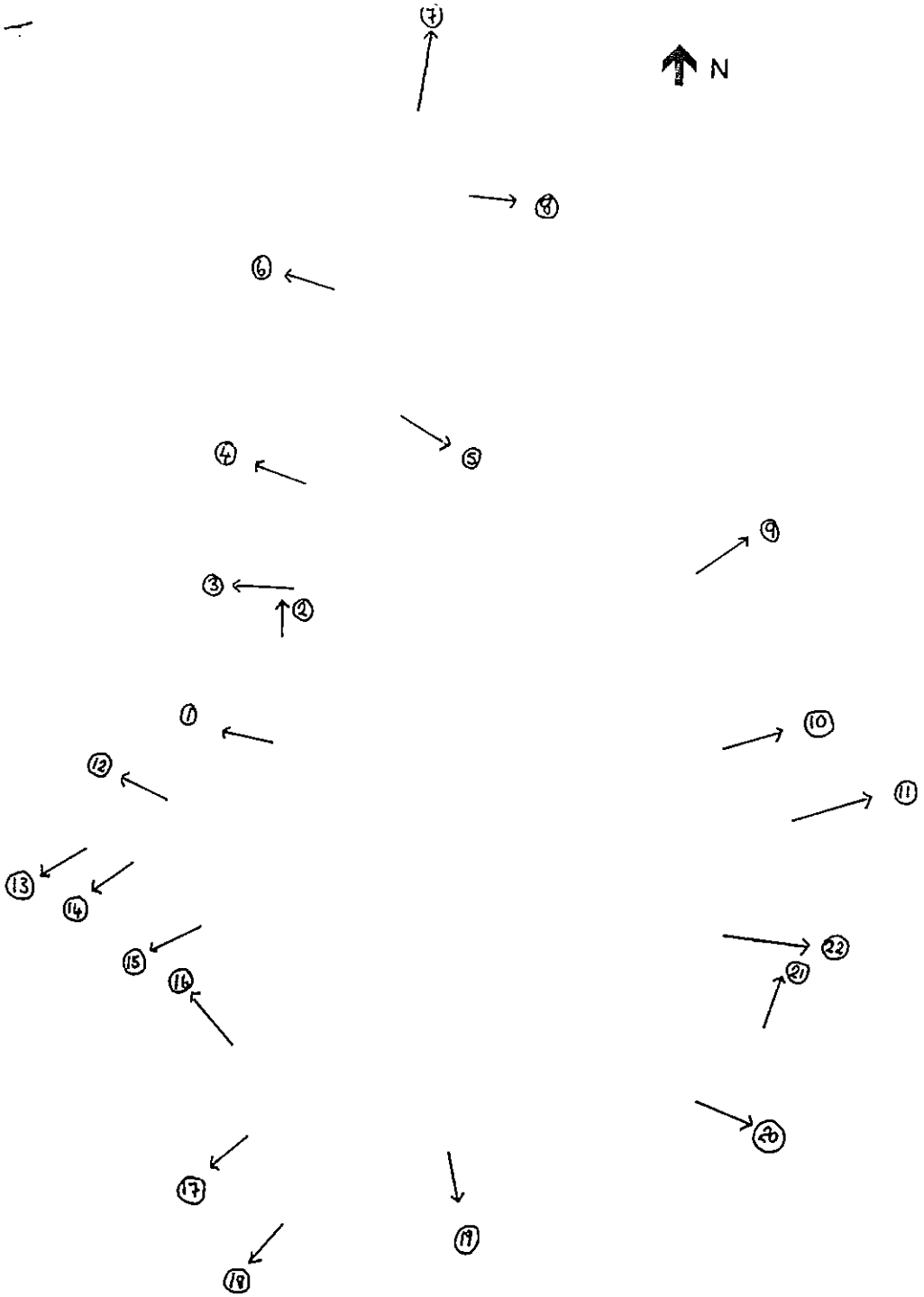
CURRAGHLEHANAGH BOG, CO. GALWAY (256).
VEGETATION MAP (1:10.560)
1994



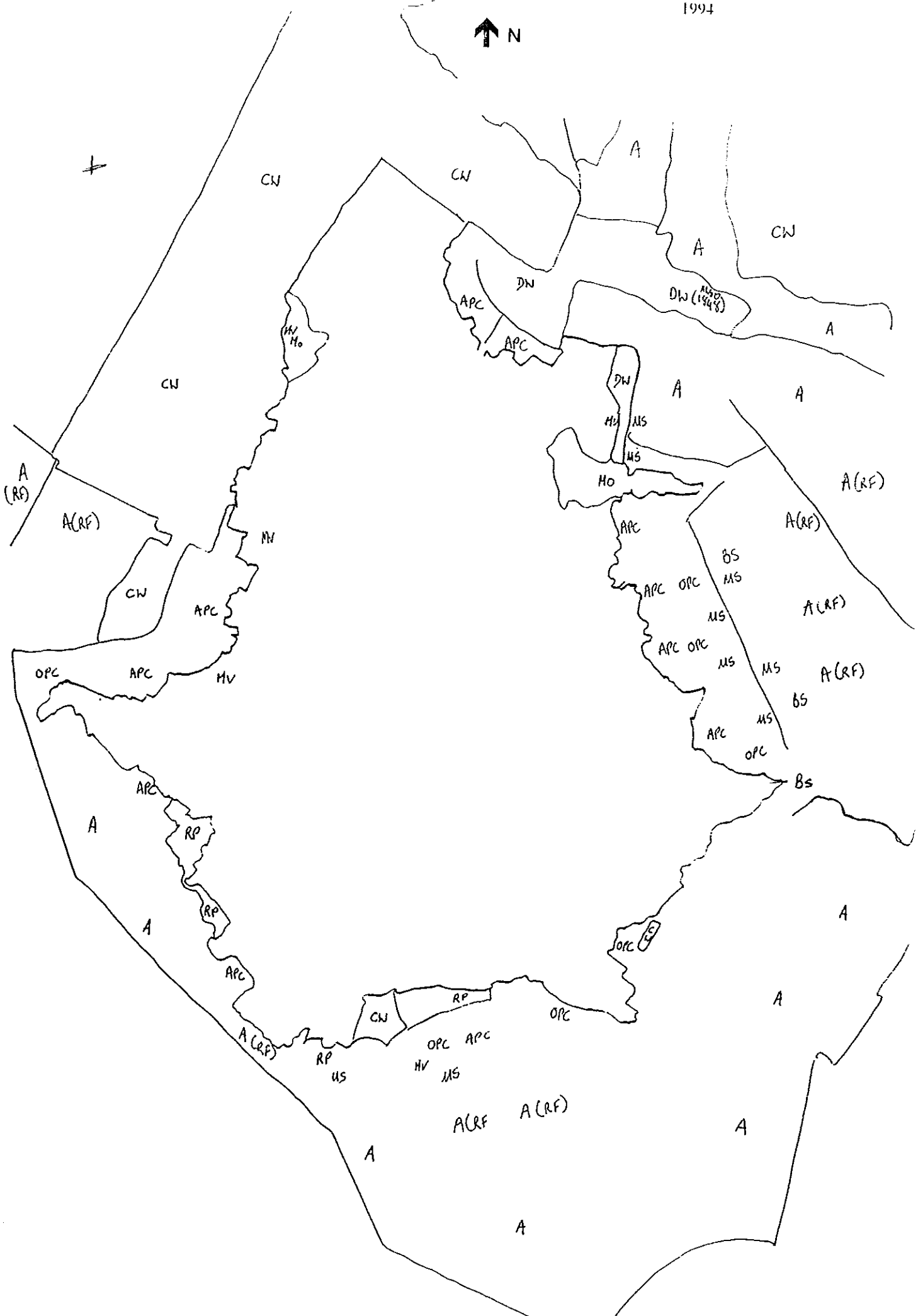
CURRAGHLEHANAGH BOG, CO. GALWAY (256)
ECOTOPE MAP (1:10,560)
1994



CURRAGHLEHANAGH BOG, CO. GALWAY (256).
SLOPES MAP (1:10,560)
1994



CURRAGHLEHANAGH BOG, CO. GALWAY (256)
LANDUSE MAP (1:10,560)
1994



DERRINEA, CO. ROSCOMMON

1. SUMMARY OF SITE DETAILS

NHA No.	604	1/2" Sheet:	11
Grid Ref:	M 54 88	6" Sheet:	RN 13
GSI Aerial Photo:	M 646	Area (ha):	59.0 (High Bog)
NHA Photo:	656:21-25		
Date(s) of Visit:	21-3-94 and 10-11-94 (Ecology) 10-11-94 (Geohydrology)		
Townlands:	Derrinea and Errit.		

2. INTRODUCTION

2.1 BACKGROUND

This is one of the smallest bogs surveyed as part of this project and is one of a group of Western or Intermediate raised bogs found at the north-western edge of the area to be surveyed. It was assigned a Bi rating following the National Raised Bog Survey (Douglas and Grogan, 1986). This denotes a good quality site with wet soft and quaking areas although the hydrology maybe somewhat damaged (Cross, 1990). It was described as having extensive pool systems, well developed hummocks, quaking areas, a small lake and a mineral mound to the SE of the site (Douglas and Grogan, 1986). It was also noted that recent drainage as a result of peat cutting, especially at the west of the site was affecting the hydrology of the system.

This bog was included in the list of raised bogs for inclusion in an NNR network (Cross, 1990).

Derrinea was also visited by the NHA survey team in 1993. They described it as having an extensive area of pools and well developed hummocks. *Sphagnum* cover in these wet areas was noted as being high.

2.2 LOCATION AND ACCESS

The bog is situated approximately 10km northwest of Ballyhaunis just east of the Mayo/Roscommon border. It lies close to the northern shores of Clooúagh Lough and is surrounded on two sides (north and east) by the River Anaderryboy.

3. METEOROLOGY

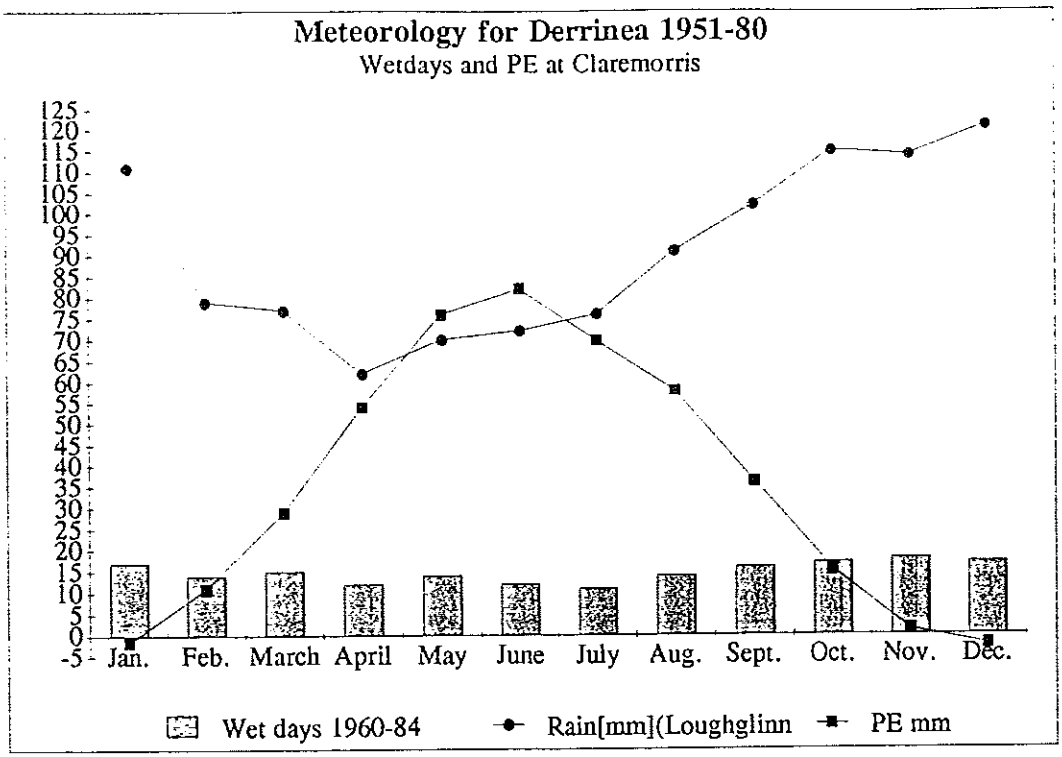
No meteorological measurements have been made on Derrinea bog. Rainfall data from the Loughglinn rainfall station for the years 1951-80 indicate that the area receives an average 1090mm of precipitation annually (Fig. 15).

Evapotranspiration from a wetland is most difficult to determine in practice. On a large exposed Midland bog such as Clara, wind fetches are long, and evaporation may occur at near open water rates when levels are close to surface and evapotranspiration occurs from the vegetation itself (Daly and Johnston, 1994). The recent Irish and Dutch work at Clara and Raheenmore suggests that actual evapotranspiration losses from the bog surface were found to be significantly more than estimated using potential evapotranspiration data from a regional, conventionally sited Meteorological Service station (Daly and Johnston, *op. cit.*).

The above factors suggest that the year round actual evapotranspiration (AE) from Derrinea Bog is greater than PE at Claremorris, site of the nearest synoptic station which had an average PE of 428.1mm/yr (1951-81) calculated by the Penman method. Annual evapotranspiration losses from the bog surface at Derrinea would therefore be greater than 428.1mm/yr.

Potential recharge (PR) is the amount of water available for recharge after actual evapotranspiration has been accounted for, i.e. PR = P - AE. PR for this bog is therefore less than 662mm/yr.

Figure 15:



Meteorological data for Derrinea Bog (1951-1981) are summarised below:

Rainfall (P)	1090mm/yr
Actual Evapotranspiration, (AE)	>428.1mm/yr
Potential recharge, (PR)	<662mm/yr

4. GEOMORPHOLOGY

4.1 TOPOGRAPHY OF THE HIGH BOG

This is a circular and rather flat bog with a low mineral ridge to the west and a *Calluna* dominated mound to the south. Some marginal slopes associated with peat cutting and tbe river are seen.

4.2 TOPOGRAPHY OF THE SURROUNDING AREA

Derrinea lies within an undulating plateau of sand and gravel deposits and small lakes. The area is coincident with the zone of convergence (Warren and Ashley, 1994) of two ice domes, the northern dome and central dome, which occurred in the last glaciation ~18,000BP. During deglaciation the ice domes at the zone of convergence separated forming an interlobate area flooded by a lake system. Ridges of coarse ice-marginal lacustrine sediments accumulated in the interlobate area as the ice margins retreated to their respective centres.

5. HYDROLOGICAL SYSTEM

5.1 GEOLOGY/GEOHYDROLOGY

5.1.1 Bedrock

This area is probably underlain by cherty argillaceous bioclastic Carboniferous limestones (known as ABL).

The ABL fossiliferous limestones generally have a low permeability and are classed as a poor aquifer.

5.1.2 Subsoils (See 6" 1840s Map)

There is a substantial till ridge up to 10m high on the southern side of this bog which is covered in heather.

There is a drumlin feature immediately adjacent to drains mJ and mH. On its south side there is a 3-4m high local pit. The pit clearly shows that the drumlin is composed of pure sands with cross-bedding.

5.1.3 Depth to Bedrock

Depth to rock on the bog is unknown.

5.2 HYDROLOGY

5.2.1 High Bog Hydrology (See Drains and Hydrochemistry Map)

West

Large newly deepened drains are found along the western section of the bog (Drains bA and bE). These are associated with active peat cutting along the south-western margin. A series of pools to the west of the site along drain bE are tear pools.

Drain bA running east/west at the south-west of the site forms part of a townland boundary, is approximately 0.5-1m wide and is infilled with *Sphagnum cuspidatum*, *S. auriculatum* and *Eriophorum* with *S. papillosum* at the edges. Part of the drain at the eastern end has recently been deepened and widened and is up to 1m wide. There is a ridge of tall *Calluna* to the N of the Eastern section of the drain. There is water ponding behind this with *Sphagnum cuspidatum* and *E. angustifolium*. There is another section of this drain to the W of the bog. It is not very well defined but has a fence along it. There is tall *Calluna* growing at the base of the stakes. There is a line of spoil heaps along the S from the recently deepened and widened section of the drain and these could be used to block this drain.

Drain bE, on the west of the site was not present on the 1970s aerial photograph but was mentioned by Douglas and Grogan (1986). It runs NNW and is 1.5m - deep by 3m wide at the top with 0.2m of water flowing towards the north. It is bare of vegetation except for some *E. angustifolium* and the peat is very dark (well humified). There are erosion channels running into the SE edge of the drain. This area was once full of pools but these have been affected by this drain. Tall *Calluna* is seen along its edges with some *Molinia* encroaching from the adjacent mineral ridge. There are large *Calluna* mounds to the W of this drain - possibly spoil heaps - and these could be used to block the drain at some time in the future.

East

Drain bC, running NW/SE at the east of the site, extends close to the wet central area (Complex 35) and is associated with Slope 4. It is an old drain infilling with *Sphagnum cuspidatum*, *C. panicea*, *E. angustifolium*, *Calluna*, *Narthecium* and some *Molinia*. There is tall *Calluna* along it with *Polytrichum alpestre*, *S. capillifolium* and *Aulacomnium*. There is still water flowing eastwards.

Drain bD, a double drain, is old and infilled but still has flow to the east at the bog edge. The following species were noted in the drain: *Sphagnum cuspidatum*, *S. magellanicum*, *Eriophorum*

angustifolium and *E. vaginatum*. Between the double drains is a very dry area dominated by tall *Calluna*. There is *Molinia* at the edge of the drain.

South East
Drain bB is 1m deep with collapsed sections (PL3:32). There is *Calluna* dominated vegetation along its edge and old spoil heaps or abandoned turf piles dominated by *Campylopus introflexus*. There is a high water table in the drain and it is infilled with some *Sphagnum cuspidatum*, *S. auriculatum* and *E. angustifolium*. There is some flow to the E.

South
There are some old drains at the south and south east corner of the site on the high bog which are associated with old peat cutting at those margins. Slumping of the bog surface in this area is occurring.

5.2.2 Bog Margin Hydrology with Face Bank Details (See Drains and Hydrochemistry Map)
South
The south side of this bog lies alongside the northern edge of Cloouagh Lough. It is serviced by a well tarred road which runs between the lake and the bog. The main bog runs up to the northern side of the road where there are many old turf banks with some stagnant water pools. There are remnants of the bog on the southern side of the road, beside the lake shores. The deepened Anaderryboy River flows into this lake on the south-eastern side of the bog.

There is a main drainage outlet (1) - an extension of stream mF - which drains the mid-southern side of the bog at the main entrance. It is 1.5m deep and 2m wide at the top and the water is 10cm deep with fast flow. The bottom of this drain lies in a silty sandstone till. The peat lies above this till at a depth of 1.2m.

Generally there is very limited cutting on any part of the bog. The only cutting occurs in the SW where there is a 2m high hand-cut face.

West
The entire western side of the bog is dominated by a rectangular drainage system, as apparent in the aerial photograph. They are drains bA, bE, bG (N end of Drain bE), mK and mJ. The water from each of these drains moves N to the Anaderryboy river via drain mH.

Drain/stream mF to the west of drain bE seems to be coming from the mineral ridge immediately to the north of it.

Drain mK, is a 1m deep drain that runs NNW onwards to drain mJ. Mid-way along its course, this drain sits entirely in a mound of till. The till has a silty matrix with pockets of sand in parts. Near drain mK's junction with drain mJ, the peat becomes thicker, up to 2m deep in a 2.1m deep drain.

Drain mH, is 1.5m deep entirely in peat flows to the north.

North & East
The Anaderryboy River is very deep (> 3m) and wide (> 10m). It drains the entire northern and eastern part of the bog. The river bank is up to 5m wide. The corresponding bog faces are about 1-3m high with no cutting. Natural erosion channels form intermittent gaps between the faces.

5.3 HYDROCHEMISTRY

5.3.1 Field Hydrochemistry (See Drains and Hydrochemistry Map)
South
The EC at the northern edge of Cloouagh Lough was 299 µS/cm.
The EC at the main drainage outlet (1) - extension of stream mF - near the main entrance of the bog in the south-west corner was 116 µS/cm.
The EC at the hand-cut face in the SW was 84 µS/cm.

At the lake in the southern part of the bog the EC is 56 µS/cm.

West
Mid-way along Drain mK, the water increases in electrical conductivity and its surface is iridescent with iron. The EC ranges from 195 µS/cm to 350 µS/cm. Near drain mK's junction with drain mJ, where the peat becomes thicker the EC was 107 µS/cm.

Drain mH had an EC of 80 µS/cm; the high ECs from the rectangle was thus diluted from bog water run-off.

5.4 GEOHYDROLOGICAL OVERVIEW

Regional Situation
This bog lies within a glaciofluvial/laeustrine gravel area where there are many lakes and streams. The bog lies in a discharge zone for groundwater but has since evolved to form a recharge unit to the area.

Bog Regime
There are relatively few drains on the high bog and there is a limited extent of cut-away where it only occurs to the south.

Inter-relationship of topography hydrology and hydrogeology
The underlying subsoils are sandy and highly permeable and form a large local aquifer. It is hypothesized that the bog formed on depressions between the local sand and gravel highs over an impermeable iron pan at depth.

6. VEGETATION

6.1 VEGETATION SUMMARY

This is a transitional or western raised bog with many affinities to blanket bog. Plants more often associated with blanket bogs were found - *Pleurozia purpurea* (in all complexes) and *Campylopus atrovirens*. Plants more associated with midland raised bogs, such as *Andromeda polifolia*, were not seen. There was also very little *Sphagnum magellanicum* - typical of pool edges on midland raised bogs - recorded. There is no slope out of the bog to the south-west and it appears that at some stage in the past, blanket peat may have developed on the lower slopes of the drumlins and mineral ridge in this part of the bog (separated from the main bog by the new Drain bE). The mineral ridge is dominated by grass species with some *Ulex* and *J. effusus*. A small stream is seen running between this mound and a further mound to the W and then along the flank of the western mound. This area is very wet and species noted were *E. angustifolium, Myrica, Potamogeton polygonifolius, Potentilla palustris, Juncus effusus, J. bulbosus, Molinia, Carex limosa, C. rostrata* and *S. cuspidatum*. The EC of water in this area was only 55-60 µS/cm but there had very heavy rain the few days previous to the survey.

On the high bog there is a well developed sequence of pools and hummocks more characteristic of blanket bog rather than raised bog. These fall into two vegetation complex categories. On the marginal slopes of the high bog there is a band of vegetation dominated by *Narthecium, Carex panicea* with increasing amounts of *Trichophorum cespitosum* along parts of the western and north-eastern slopes. There is an area of *Narthecium* and *Trichophorum* dominated vegetation in the north-eastern corner of the site. There are some *Calluna* dominated mounds on the high bog to the south. *Carex limosa* is found in pond Z and in some of the larger pools in Complex 35.
The vegetation around much of the site is influenced by the close proximity of the river to the N and E edges. It has been arterially drained resulting in steep riverside banks resulting in drainage which in turn reduces the prospect of a natural gradation from bog to reed bed to river around these edges. Species seen in the river include *Nuphar, Typha, Scirpus lacustris, C. rostrata, Callitriche, Menyanthes, J. articulatus, Sparganium emersum, Equisetum fluviatile, Lemna* and *Mentha*. Along the river banks, where it borders the site, there is a band of vegetation which extends up to

approximately 20m wide at the E of the site but is generally much narrower. The vegetation in this band consists of *Molinia caerulea, J. effusus, Myrica gale, Filipendula, Angelica, Calluna* and *Eriophorum angustifolium* (PM 1:16). *Calluna* and *Molinia* dominate closer to the bog. The drop to the river along the northern and eastern edges is significant.

In the cut-away areas to the S and SSE of the site there is old and active peat cutting. There are many old turf banks dominated by tall *Calluna* with *E. angustifolium, J. effusus* and *Molinia*. The dominant plants in the infilling drains are *Molinia, E. angustifolium* and regenerating peat on the old cut-away areas. The active peat cutting is mainly by Difco and there is much bare peat.

6.2 DETAILED VEGETATION OF THE HIGH BOG

The present vegetation cover of the bog is divided into a number of community complexes, which are described according to the community types they contain. The distribution of the community complexes is shown on the Vegetation Map.

These community complexes are also divided into ecotope types (See Ecotope Map).

6.2.1 Complexes

Marginal Complexes

Complex 1

The facebank complex is seen along the northern edge, eastern edge, between the double drain bD, along Drains bB and bE and on the mounds to the south of the site. The facebank complex along the N and E edges extends down a steep facebank to the river bank (see Slopes 4, 5 and 7). The facebank is 2m tall along the E edge rising to 2.5m at the N edge and there are natural erosion channels present which are dominated by *Molinia*. The *Calluna* reaches heights of 0.7m along the facebank, approximately 0.8m (PM14:1) on the mounds and 0.5m at the edge of Drain bE. *Cladonia portentosa* is present on the mounds.

Complex 2/3

This is seen to the W of Drain bE between it and the stream from the mineral mound (mF). *Trichophorum* and *Carex panicea* dominate. Some *Narthecium* also occurs. The bog surface is very dry and hard underfoot. It has been very heavily poached by cattle.

Complex 3/2 + Erosion Channels (ER)

This sub-marginal complex occurs as a very narrow band along the N and E edges of the bog and in the SW corner close to Drain bE. It is bounded at the edge by Complex 1 +*Molinia* +Erosion Channels. The complex is dominated by *C. panicea* and *Trichophorum* with patches of *Molinia* and some *Calluna* and there are some erosion channels with *R. alba*. These channels are at the heads of natural erosion channels along the steep facebank edge. *Myrica* was seen in this complex close to Drain bD.

Complex 2/6/3

This complex is seen near the SSW edge of the site between the large mound and Flush Z. It is dominated by *Trichophorum* (25%), *Narthecium* (20%), *C. panicea* (10%) and *Calluna* (25%) up to 35cm tall but dying. The *Sphagnum* cover is low, made up mainly of *S. papillosum, S. capillifolium, S. subnitens* and *S. tenellum* and the surface not soft. There is scattered *E. angustifolium* and *E. vaginatum* with 5% *Cladonia. Pleurozia purpurea* was seen.

Complex 7/9

This is seen to the SE of the site just behind the face bank complex. *Calluna* (35cm tall) and *E. vaginatum* dominate with some *Narthecium* also present. The surface is not very soft.

Complex 3 (PL3:31 at the south east of the site)

This vegetation complex is found on the lower slopes at the SE of the high bog. It is dominated by *Carex panicea* (up to 35%), *Trichophorum* (15%), *Calluna vulgaris* which reaches 20-30cm in height and *Eriophorum vaginatum* (PM 1:15). *Sphagnum* cover is low (10%) and includes *S.*

capillifolium, *S. subnitens* and *S. papillosum*. There is a large amount of *Hypnum jutlandicum* and lesser amounts of *Racomitrium*. There are also some *Narthecium* hollows and 10% cover of *Rhynchospora alba*. *Cladonia* species found include *C. portentosa* and *C. uncialis*. The acrotelm layer appears to be rather shallow or absent.

Complex 6/2
This is found in the north east corner of the site and is characterised by an abundance of *Narthecium* flats/hollows. There is also a high cover of *Trichophorum cespitosum*, which increases towards the edge, with small algal hollows (5%) some with *S. cuspidatum*. *Sphagnum* cover is low and the ground hard. *Calluna* (20%, up to 35cm tall) and *C. panicea* (5%) with scattered *E. angustifolium* and *E. vaginatum* make up the remainder of the vegetation. *Racomitrium lanuginosum* was recorded and there is a band of *Molinia* encroaching on to the high bog at the NE edge.

Complex 6/3/2
This complex was seen at the eastern side of the large mound at the S of the site and extends to the southern bog edge. It is dominated by *Narthecium* 45% with a variable amount of *C. panicea* up to 15% and *Trichophorum* 10% increasing towards the bog edge. There is very little *Calluna* - up to 5% and it is patchy and dying. There is also very little *Sphagnum* and the ground is not soft. There is some scattered *E. angustifolium* and *E. vaginatum*.

Sub-Marginal Complexes
Complex 3/6
This is quite similar to Complex 3 but with an increase in *Narthecium* hollows and *Trichophorum cespitosum* - up to 20%. The complex is found at the N and E of the site. A burning/disturbance history is suggested by the presence of *Campylopus introflexus*. The surface is soft despite the low *Sphagnum* cover which is made up chiefly of *S. tenellum* and *S. capillifolium*. There are some algal hollows. North-west of Pool X there is an increase in *Sphagnum* cover - *S. capillifolium* and *S. fuscum* hummocks are present and some pools. There is 15% *Calluna* throughout most of the complex but this increases towards the edge (30-40cm tall). There is more *C. panicea* in the E area of the complex than in the N section. *Pedicularis sylvatica* and *Racomitrium* were seen. To the E side of the bog some tear pools are seen in this complex which are orientated N/S. These are infilled by *S. cuspidatum* and *R. alba* with *S. papillosum* at the edges.

Complex 6 + Algal Pools (AP)
This complex is seen to the N of the large mound at the S of the site and is dominated by 60% *Narthecium* with 10-15% each of *C. panicea*, *Calluna*, *E. vaginatum* and *Trichophorum*. The *Calluna* is up to 35cm tall and is dying. There is up to 5% algal pools with *Campylopus atrovirens* at the edge. The ground is soft though there is very poor *Sphagnum* cover. *S. fuscum* was seen. There is scattered *E. angustifolium* throughout the complex and *Racomitrium* was seen.

Complex 6/3
This complex is seen to the E of the bog. *Narthecium* and *Carex panicea* dominate as in Complex 6/3/2 but the cover of *Trichophorum* is lower. The bog surface is softer than in Complex 6/3/2. *Huperzia* was recorded to the east of Pool Y.

Sub-Central Complex
Complex 6/3 + Pools (P)
This is similar to the above complex with the addition of pools. These are smaller than in Complex 35 and are similar to the smaller pools seen in Complex 6/35. The inter-pool areas are dominated by *Narthecium* and *Carex panicea* with some *R. alba*. *Sphagnum* cover is moderate and the bog surface is soft. It is probably transitional between Complexes 6/3 and 6/35

Central Complexes
Complex 6/35
This is found on a flat area of the central bog and is characterised by linear tear pools many of which are algal. Some pools support a healthy growth of *Sphagnum cuspidatum*. The inter-pool areas are dominated by *Narthecium*, *R. alba* and associated hollows, *Calluna* and *Eriophorum vaginatum* with some *E. angustifolium* and *Carex panicea*. There is much *Campylopus atrovirens* around the

pool edges with *Sphagnum capillifolium* and *S. papillosum*. An acrotelm layer is present. The large pools in the vicinity of drain E are tear pools (PM1:19-21 and PM19:22-25).

Complex 35

In this complex the pools form inter-connecting patterns and there is an increase in the amount of *Racomitrium lanuginosum* which forms large island hummocks (PL3:37 and PM1: 22-25). This complex is found on the central part of the bog and around pool Z. In the pools *Sphagnum auriculatum* var. *auriculatum* (PL4:3), *S. cuspidatum*, *Menyanthes* and some *Carex limosa* are seen with *Campylopus atrovirens* (PL4: 4) at the pool edges. The inter-pool areas have an increased amount of *Eriophorum angustifolium* (20%) (compared to Complex 6/35) with *S. capillifolium*, *S. papillosum* and *S. magellanicum* and there are some *S. fuscum* and *S. imbricatum* hummocks. *R. alba* is also very frequent in the inter-pool areas (10-15%). The surface is soft and wet.

This complex is somewhat similar to Complex 6/35 as *Narthecium* and algal hollows are still frequent.

At the mid-east side of Complex 35 there is a NNW/SSE line of *Molinia* approximately 40m long. *Calluna* (45cm tall), *Potentilla erecta, Vaccinium oxycoccus, Pleurozium schreberi, Aulacomnium palustre, Hylocomium splendens* and *S. capillifolium* also occur. In a pool just to the W of this line of *Molinia*, *Carex rostrata* was noted (EC 64 µS/cm). There may be a hydrological link between this area and the mineral mound to the S.

6.2.2 Flushes/Pools

Pool Z

This is the largest pool on the site (EC 54 µS/cm) (PL3: 30 looking NW towards it and PM1:16 showing infilling) and is beside the smaller of the two *Calluna* dominated mounds. Much of the pool is infilled with *Sphagnum cuspidatum* and *S. recurvum* var. *mucronatum*. Where there is open water *Carex limosa* was found. Around the edges *Empetrum nigrum* and *Vaccinium myrtillus* were noted.

Pool Y

This is seen to the east of the site approximately 25-30m N of the E end of Drain bA. It is a circular pool about 15m in diameter with a 0.25m bank around the edges. The water table is quite high (EC 78 µS/cm). It is infilling with *Eriophorum angustifolium* and *Sphagnum cuspidatum*. This pool is located in a depression with slopes into it from the north, east and west of it sloping into it (PM1:18 looking west at the slope and including the large mound and PL3: 33 and 34). The area seems to be subjected to run-off.

In the vicinity of pool Y the vegetation becomes dominated by *Carex panicea* and is quite soft underfoot. There is a very low *Calluna* cover (5%). The area was quite possibly burnt. There is more *Trichophorum cespitosum* and less *Eriophorum vaginatum* than in Complex 3/6 with some *Huperzia selago* also present. (PL3: 33 and 34 looking NE to show this; PM1: 18 looking towards the large mound to show that both the pond Y and *Carex panicea* dominated community are in a depression).

Pool X

This is a double linear pool seen at the north of the site (PM19:26-27) in a wet area (EC 78 µS/cm). *Sphagnum recurvum* var. *tenue* was recorded. The pool is infilling with *S. cuspidatum*, *S. auriculatum, Menyanthes, E. angustifolium* and abundant *S. papillosum* at the edges, Between the two pools is tall *Calluna* with up to 20% *Cladonia* and a high cover of *Pleurozium schreberi*.

There are some *Calluna* dominated mounds on the high bog to the south with *Quercus petraea* growing on the largest. This mound is 2.5m tall by 30m wide on the NE/SW axis and 70m wide on the NW/SE axis. A patch of *Molinia* and *Pteridium* is seen on the N side of this mound and some small amounts of *Molinia* are encroaching into the bog vegetation to the N. At the NW side there is a small area where *E. vaginatum* and *Calluna* dominate. The other mounds are about 0.5m tall with tall *Calluna*. The mounds are probably associated with underlying mineral soil.

7. BOG TYPE

This bog has been classified as a Ridge River C bog type.

8. HUMAN IMPACT

8.1 SLOPES AND RELATIONSHIP TO VEGETATION

8.1.1 Slopes (See Slopes Map)

Slope 1 This slope is at the SSE of the site along Drain bB and is 1.5m over 60m to the river. The slope along the drain is less - 0.25m over 30m - indicating that the steepest part of the slope is at the very edge of the bog.

Slope 2 This slope from the eastern edge of Pool Y to the bog edge is 0.75m over 50m passing through Complex 3/2 + Erosion Channels (natural) near the edge.

Slope 3 This is to the S of Drain bC at tbe bog edge where there is a steep facebank to the river bank. It is 2.5m over 10m. There are natural *Molinia* dominated erosion channels and where these occur the slope is over a shorter distance.

Slope 4 This is in the vicinity of Drain bC and is 0.75m over 10m at the edge of the drain.

Slope 5 The slope along Drain bD is very gradual except at the edge where there is a steep facebank - 2m over 5m.

Slopes 6 & 7 This very gradual slope to the NE corner of the bog from the SW is 10cm over 70m. The very steep facebank at the NE end of Slope 6 is 3m over 3m to the river bank with natural erosion channels (PL3: 35).

8.2 RECENT HUMAN IMPACT

8.2.1 Peat Cutting

The presence of the River Anaderryboy around both the N and E of the site restricts access for peat cutting. There is old cut-away east of the river. There is active peat cutting to the south and south west of the site with many drains criss-crossing the area. Slumping is occurring at the south-east of the site due to peat cutting and associated drainage which was carried out in the past. The active peat cutting near the junction of Drains bA and bE is mainly Difco. There is also some active peat cutting in the old cut-away to the SSE of the site and this is mainly by hand and the facebanks are up to 2m tall. Some peat cutting as also carried out in the past along some of the old drains on the bog - Drains bB and bD. The outfall stream from the mineral mound to the W of the site (mF) flows through the cut-away at the mid S of the site and has been recently re-dredged (since Mar '94) and deepened (EC 111 µS/cm).

8.2.2 Forestry

There are coniferous plantations to the north and east of the River Anaderryboy on cut-away peat. Some of it is quite recent. There was no forestry shown on the 1970s aerial photograph.

8.2.3 Fire History

There are indications that areas on the lower slopes of the site have been burnt in the past and this is evidenced by the presence of some *Campylopus introflexus*. The central communities appear to have escaped recent burning though there is evidence of burning in that the highest *Cladonia* cover is confined to islands and tall hummocks near pools.

8.2.4 Cattle Poaching

Cattle poach the W of the site between Drains bE and mK in Complex 2/3.

9. INTER-RELATIONSHIPS OF VEGETATION, HYDROLOGY, TOPOGRAPHY AND LOCATION

1. As peat cutting has been restricted by the river on two sides of the site and the site is quite flat, a relatively large area of central permanent pools is seen.

2. Recent activities include the deepening of drains bA and bE at the west of the site. There is slumping as a result along the south-east of the bog and large tear pools are seen in the vicinity of drain bE.

3. *Pleurozia purpurea* and *Campylopus atrovirens*, typical western indicators are seen all over the site. Plants more associated with midland raised bogs, such as *Andromeda polifolia*, were not seen. There was also very little *Sphagnum magellanicum* recorded.

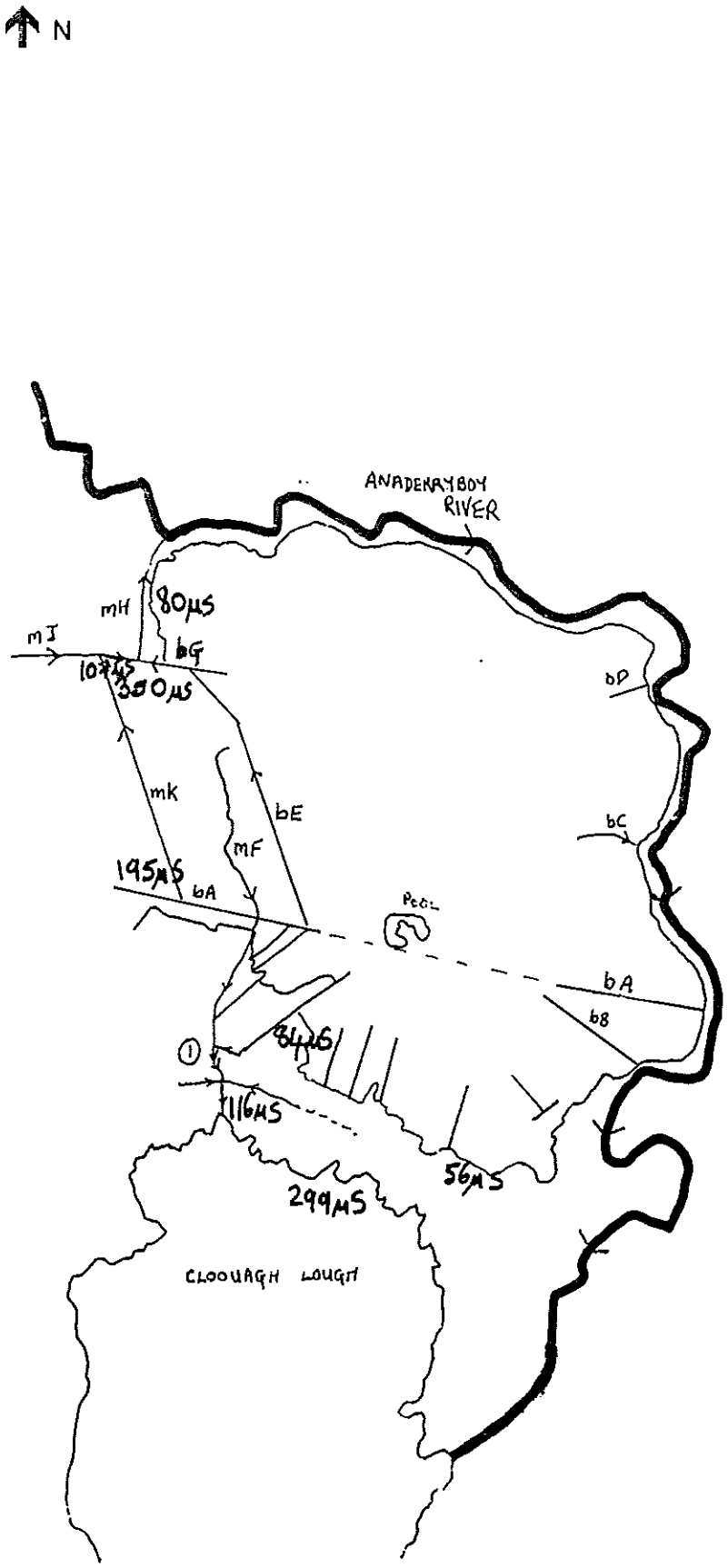
4. At the S of the site there are two till mounds. The larger of this is partly wooded with *Quercus*. At the base of the smaller ridge there is a pool where some more minerotrophic species were recorded.

5. At the east of the site there is a circular pool which may be a swallowhole. It is infilling with *Eriophorum angustifolium* and *Sphagnum cuspidatum*. It is located in a depression.

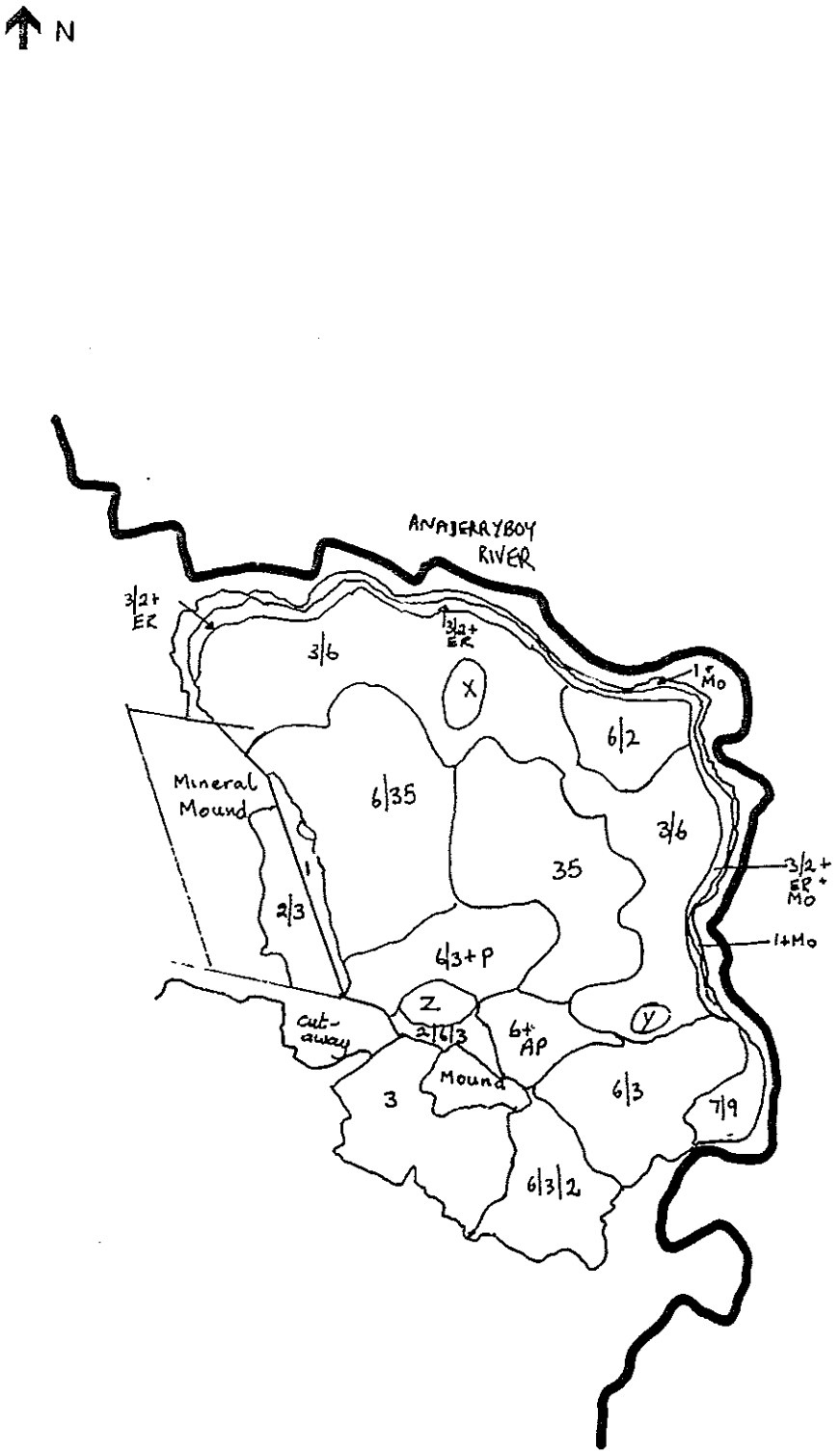
Lara Kelly
Marie Dromey
Malcolm Doak

Raised Bog Restoration Project (1995).

DERRINEA BOG, CO. ROSCOMMON (604).
DRAINS AND HYDROCHEMISTRY MAP (1:10,560)
1994

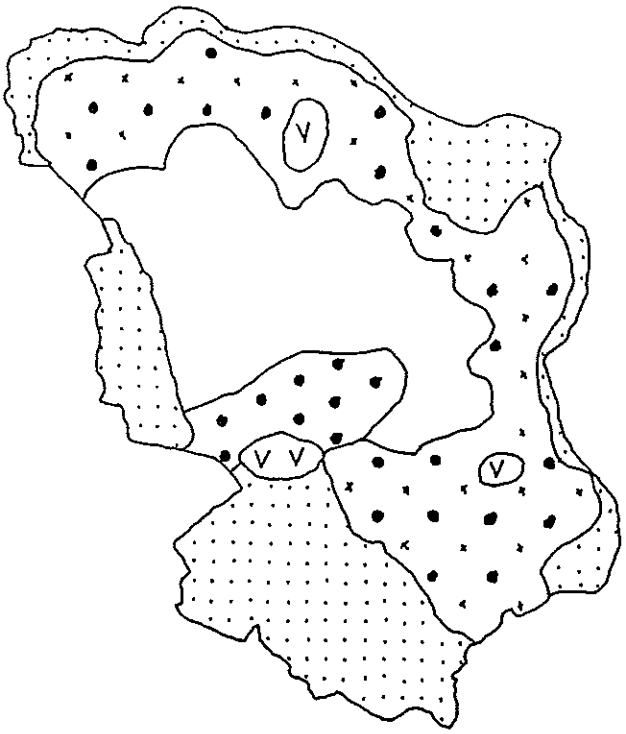


DERRINEA BOG, CO. ROSCOMMON (604).
VEGETATION MAP (1:10,560)
1994

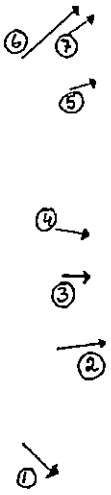


DERRINEA BOG, CO. ROSCOMMON (604)
ECOTOPE MAP (1:10,560)
1994

N



DERRINEA BOG, CO. ROSCOMMON (604).
SLOPES MAP (1:10,560)
1994



DERRINEA BOG, CO. ROSCOMMON (604).
LANDUSE MAP (1:10,560)
1994