Ballyduff Bog (SAC 000641), Co. Tipperary

Executive Summary

This survey, carried out in September 2011, aimed to assess the conservation status of habitats listed on Annex I of the European Habitats Directive (92/43EEC) on the high bog at Ballyduff Bog. Vegetation was described and mapped based on raised bog ecotope vegetation community complexes (Kelly and Schouten, 2002). The following Annex I habitats occur: Active Raised Bog, Degraded Raised Bog and Depressions on peat substrates of the Rhynchosporion.

Active Raised Bog covers 15.16ha (17.49%) of the high bog area. The highest quality example of Active Raised Bog consists of *Sphagnum* lawns, pools, hummocks and hollows. *Sphagnum* cover reaches >90% in certain locations. Active Raised Bog also includes some active peat forming flushes.

Degraded Raised Bog covers 71.51ha (82.51%) of the high bog area. It is drier than Active Raised Bog and supports a lower density of *Sphagnum* mosses. It has a less developed micro-topography while permanent pools and *Sphagnum* lawns are generally absent.

Depressions on peat substrates of the Rhynchosporion is found in both Active and Degraded Raised Bog, but tends to be best developed and most stable in the wettest areas of Active Raised Bog.

Restoration works took place at the site in December 2003. This involved the blocking of the drains in the drainage complex in the south of the site that were inserted in association with moss peat exploitation in the late 1990s.

The current conservation objective for Ballyduff Bog is to restore the area of Active Raised Bog to the area present when the Habitats Directive came into force in 1994. In the case of Active Raised Bog, the objective also includes the restoration of all of the sub-marginal

ecotope present at the time as this represents the area of Degraded Raised Bog most technically feasible to restore. The Area objective for Active Raised Bog is 60.44ha. The objective in relation to Structure and Functions (S&Fs) is that at least half of the Active Raised Bog area should be made up of the central ecotope and active flush (i.e. the wetter vegetation communities). These values have been set as Favourable Reference Values or FRVs until more site specific values can be set based on hydrological and topographical studies. The objective for Degraded Raised Bog is for the sub-marginal area to be restored to active peat forming communities as stated above and that no loss or degradation of any kind occurs. Although FRVs could not be established for the Rhynchosporion depressions, the objectives are to increase its extent and improve its quality to values associated with a favourable conservation status of Active Raised Bog. Therefore, the habitat's objectives are indirectly associated with Active Raised Bog objectives.

There has been a slight increase in the area of Active Raised Bog (0.58ha) at Ballyduff Bog in the 2004 to 2011 period. The most notable changes have occurred in the north-east of the area of the blocked drainage complex where there has been an expansion of sub-central ecotope and development of central ecotope. In addition, three new peat forming areas have been described at the site. However, these are likely to be the result of more comprehensive field mapping rather than actual changes.

Infilling processes continue in the blocked drains and only a few drains on the high bog remain functional. However, cutover drainage continues impacting on Active Raised Bog at the site. No fire events have affected the bog in the reporting period and peat cutting no longer takes place at the site, though the open face banks are likely to continue to drain the high bog. There are also scattered *Pinus sylvestris* trees on the high bog, but these do not appear to pose a major threat to high bog habitats.

Active Raised Bog has been given an overall **Unfavourable Bad-Improving** conservation status assessment. Habitat Area has slightly increased and quality improved in the reporting period, however both are below favourable reference values. Future Prospects are considered Unfavourable Bad-Improving as the high bog drains continue to infill and aid the restoration of peat forming communities.

Degraded Raised Bog has been given an overall **Unfavourable Bad-Improving** assessment as there has been some restoration to Active Raised Bog.

Rhynchosporion depressions has been given an overall **Unfavourable Bad-Improving** conservation status assessment as there has been some restoration to Active Raised Bog and no further drying of the high bog.

The **overall raised bog** at **Ballyduff SAC** (part of Ballyduff and Clonfinane SAC) has been given an **Unfavourable Bad-Improving** assessment**.**

A series of **recommendations** have been also given, these include: further hydrological and topographical studies to ascertain more accurate FRVs; further botanical monitoring surveys on the high bog and cutover to assess the efficiency of restoration works and an impact assessment of maintenance works on adjacent land drainage with a view to the potential of blocking these drains.

Site identification

SAC Site Code	000641	**6" Sheet:**	TY: 5
Grid Reference:	E 200600 / N 203400	**1:50,000 Sheet:**	53
High Bog area (ha)[1]:	86.67ha		
Dates of Visit:	13 to 14/09/11		
Townlands:	Ballyduff, Walshpark, Clonfinane, Clonraskin & Derrinlieragh		

Site location

Ballyduff Bog is located approximately 5km to the west of Birr, Co. Offaly. The road from Birr to Portumna runs by the north of the site (T 41). A road off this to the south runs along the east of the site and the site may be accessed at southeast corner. However, this is through private property and permission should be acquired first or an alternative access point found. Access may also be gained at the south of the site at the series of now blocked drains. Alternatively access may be gained from the adjacent site, Clonfinane, through a mixed woodland at the southwest of Ballyduff Bog.

Kelly *et al*. (1995) grouped Ballyduff Bog with the raised bogs of south Offaly/N Tipperary. It is adjacent to and part of the same SAC as Clonfinane, which lies to the west. It also lies approximately 5-6km to the south of All Saints Bog (SAC 566).

Description of the survey

The survey was carried out in September 2011 and involved a vegetation survey of the high bog at Ballyduff Bog and the recording of impacting activities affecting high bog vegetation. A similar survey was carried out in 2004 by Fernandez *et al*. (2005). High bog vegetation was described and mapped, based on raised bog ecotope vegetation community complexes developed by Kelly *et al*. (1995). Detailed notes were taken on each community complex and any flushed areas that were present. These included: species lists; estimation of % cover of dominant species; percentage

1 This figure is slightly smaller than the one given in 2004, as a result of improvement on mapping accuracy; based on 2010 aerial photography.

Sphagnum cover; evidence of damage (due to burning, peat cutting or drainage); micro-topography; ground firmness; and presence of *Cladonia* species. A list of photographical records is given in Appendix II. The survey aimed to assess the conservation status of Habitats Directive (Council Directive 92/43/EEC) Annex I habitats on the high bog.

The entire high bog of Ballyduff Bog was re-surveyed. Sections mapped as sub-marginal, sub-central and central ecotope in 2004 were surveyed in more detail. These are the areas where changes were likely to have occurred. Quadrats, which describe the micro-topographical features and indicator species, recorded in the 2004 project (Fernandez *et al*. 2005) were re-surveyed and additional quadrats were recorded where necessary (see Appendix III). The size of quadrats was 4m x 4m.

A GeoExplorer handheld GPS minicomputer (Trimble GeoXT) was used in the field to record quadrats, ecotope boundaries, location of vegetation complexes and other points of interest. The GPS positions of these features were logged and stored on Terrasync software (Trimble). Additional comments were stored as text fields in the device. Post processing of data was carried out, based on the Active GPS Network from Ordnance Survey Ireland, to obtain sub-metre accuracy of the data.

A digital vector format ecotope vegetation map was produced based on the spatial data collected during the survey using ArcGIS 9.3 and 2010 aerial photography. The Irish National Grid was used as the co-ordinate reference system. Vegetation complex and ecotope maps are given in Appendix IV.

Description of the high bog

Ballyduff Bog has been classified as Midlands Raised Bog (Cross, 1990) and geomorphically as a Ridge Basin Bog (Kelly *et al*. (1995). The high bog is broadly rectangular in shape with a small extra lobe in the south-east and is separated from Clonfinane Bog (part of the same SAC) by a small area of cutover.

Ecological information

Raised Bog Annex I (Habitats Directive (92/43/EEC)) habitats

The following Raised Bog EU Annex I habitats, are found in Ballyduff Bog:

- Active Raised Bog (EU code 7110),

- Degraded Raised Bog (EU code 7120) and
- Depressions on peat substrates of the Rhynchosporion (EU code 7150).

Active Raised Bog (7110)

The current area of Active Raised Bog at Ballyduff Bog is 15.16ha (17.49% of the high bog), which is a decrease of 2.88ha since 1994.

Active Raised Bog includes central and sub-central ecotope as well as active flushes.

Central ecotope was found in Ballyduff Bog at six locations (**C1 – C6**) and sub-central ecotope at eight locations (**Sc1** to **Sc8**) (see Appendix IV, Map 1). The highest quality Active Raised Bog sections consist of central ecotope (vegetation community complex 10/15) in depressed areas featuring hummocks, lawns, and inter-connecting pools (11-25%). *Sphagnum* cover is generally >90%, but is lower (75-90%) in places, and consists of *Sphagnum capillifolium, S. subnitens,* and active *S. austinii* hummocks, *S. magellanicum* and *S. papillosum* in lawns and low hummocks and *S. cuspidatum* in pools along with *Drosera anglica* and *Menyanthes trifoliata*.

Sub-central ecotope covers the largest Active Raised Bog section of the site. Complex 10/4 is the most widespread complex within sub-central ecotope (dominating in **Sc1**, **Sc2** and **Sc8**) and consists of tall *S. capillifolium* hummocks and hollows with *S. cuspidatum* in places. Overall *Sphagnum* cover is 51-75%. Other *Sphagnum* species include *S. papillosum*, *S. magellanicum*, *S. tenellum*, *S. fuscum* and active *S. austinii* hummocks.

Two other sub-central ecotope complexes are found on Ballyduff Bog; complex 10/9 in the wettest and finest quality sub-central ecotope areas features a higher content of *Eriophorum vaginatum* and complex 9/7/10 in the poorer quality sub-central ecotope areas.

Two active peat forming flushed areas are also present at Ballyduff Bog (**FY** and **FZ**).

Degraded Raised Bog (7120)

The current area of Degraded Raised Bog at Ballyduff Bog is 71.52ha (82.52% of the high bog).

Degraded Raised Bog includes the sub-marginal, marginal and face bank ecotope as well as a small area of inactive flush. Although some areas of Degraded Raised Bog have a relatively well-developed raised bog flora, they are affected by water loss to varying degrees, and are usually devoid of permanent pools.

The sub-marginal ecotope features the most developed micro-topography within Degraded Raised Bog, with a higher presence of hummocks (mostly *Sphagnum capillifolium* subsp. *rubellum*) and

hollows (frequently dominated by *Narthecium ossifragum* and only occasionally with *Sphagnum cuspidatum*). *Sphagnum*, generally, covers less than 30% of the ground and consists mostly of *S. capillifolium* subsp. *rubellum*, but *S. papillosum*, *S. tenellum*, *S. subnitens* var. *subnitens*, *S. magellanicum* and *S. cuspidatum* are also present. Very occasionally *S. austinii* and *S. fuscum* hummocks are found. *Calluna vulgaris*, *Erica tetralix*, *Eriophorum vaginatum*, *E. angustifolium*, *Rhynchospora alba*, *Narthecium ossifragum* and *Trichophorum germanicum* are also common at various levels of coverage.

Marginal ecotope is slightly drier than sub-marginal ecotope and mainly occurs as a narrow band near the margins of the high bog. The micro-topography consists of *Calluna vulgaris* hummocks, low *Sphagnum* hummocks, flats and occasionally hollows. The *Sphagnum* cover is even lower here than in the sub-marginal ecotope (generally <10%) and the vegetation is characterised by higher cover of *Trichophorum germanicum* and *Calluna vulgaris*. There is also a high cover of *Eriophorum vaginatum* and *E. angustifolium* in the area within the blocked drainage complex.

Face bank ecotope is characterised by firm ground, tall *C. vulgaris*, poor *Sphagnum* cover and flat micro-topography. It is restricted to a narrow band along the perimeter of the high bog, and is found mainly in the east and north of the site.

Isolated *Pinus sylvestris* trees are also scattered throughout the site, though are particularly frequent in the south-west. The degraded raised bog at Ballyduff Bog also includes an area of approximately 12ha in the south of the site that was extensively drained in the late 1990s in association with peat moss exploitation. These drains were blocked in December 2003 and the area is re-wetting with sub-marginal ecotope now present in parts. However, there are still relatively large areas of bare peat in places as well as a high cover of *Campylopus introflexus*.

Depressions on peat substrates of the Rhynchosporion (7150)

Rhynchosporion vegetation is widespread on Ballyduff Bog. It is found in both Active and Degraded Raised Bog, but tends to be best developed and most stable in the wettest areas of Active Raised Bog. In these areas, the Rhynchosporion vegetation occurs along pool edges and on lawns underlain by deep, wet and quaking peat. Typical plant species include *Rhynchospora alba*, *Sphagnum cuspidatum*, *S. magellanicum*, *S. papillosum*, *Drosera anglica* and *Eriophorum angustifolium*. *Rhynchospora alba* is most frequent at Ballyduff Bog in the sub-central complex 10/4, which dominates much of **Sc1** as well as **Sc2** and **Sc8**.

R. alba was also found within degraded raised bog, but always associated with wet features such as hollows.

Detailed vegetation description of the high bog

A detailed description of high bog vegetation recorded during the 2011 survey of Ballyduff Bog is given in Appendix I. Vegetation is divided into a number of community complexes, which are listed and described based on the dominant species. These community complexes are grouped into ecotope types. The distribution of the ecotopes is shown on the ecotope map (Appendix IV, Map 1). The community complexes are shown on the community complex map (Appendix IV, Map 2) and the quadrat details are given in Appendix III and their location in Appendix IV (Map 1).

Impacting activities

Table 6.1 below provides a list of activities impacting high bog vegetation at Ballyduff Bog, according to their occurrence on the high bog or adjacent to the high bog; area or length affected and whether they influence negatively (i.e. drainage, peat extraction) or positively (i.e. restoration works).

Table 6.1 Impacting activities

Code	Activity	Ranking	Influence	Area (ha) /Length(km) affected	Location	Habitat affected
C01.03	Peat extraction	L	-1	0.03ha cut away	2 different locations (plots) along eastern high bog section	**7110/7120/7150**
J02.07	Drainage	M	-1	11.825km [1]	On HB	**7110/7120/7150**
J02.07	Drainage	M	-1	n/av	Adjacent to HB	**7110/7120/7150**
I01	Invasive alien species	L	-1	<0.1ha [3]	On HB	**7110/7120/7150**
B01.02	Artificial planting on open ground (non-native trees)	L	-1	n/av	Adjacent to HB	**7110/7120/7150**
4.2	Restoring/Improving the hydrological	H	+1	9.302km [2]	On HB	**7110/7120/7150**

	regime

HB: High Bog; Ranking: H: High importance/impact; M: Medium importance/impact; L: Low importance/impact.

[1] This figure only includes functional and reduced-functional drains (some of them blocked).

[2] This figure includes only blocked drains on the high bog.

[3] This figure is estimated and represents the extent of trees across entire high bog

n/a: not applicable, n/av: not available

Peat cutting

Peat cutting has taken place at the site at two different locations along the eastern section of high bog in the 2004 – 2011 reporting period. As a result 0.03ha have been cutaway. According to NPWS regional staff, peat cutting no longer continues at the site. The activity is given a low importance/impact because of the small amount of peat cut away and the cessation of the activity. However, old face banks and cutover drainage associated with cutting continue to cause negative impacts on the high bog habitats.

Drainage

High bog drainage

Although there have been no major changes in the status of high bog drains. Infilling has continued taking place within the blocked drain complex ND on the southeast corner of high bog. Active Raised Bog and sub-marginal ecotope have expanded within this section, which in 2004 was mapped almost entirely as marginal ecotope.

Overall, the majority of drains in the high bog remain reduced functional (11.825km). Only bD drain complex (0.643km) remains functional. Some of the reduced functional drains are also impacting the high bog habitats and will continue to do so until they become completely in-filled and therefore non-functional.

High bog drainage is considered to have medium importance/impact on high bog habitats.

Table 6.2 High bog drainage summary

Status	**2004 (km)** [1]	**2011 (km)**	**Change**
NB: functional	0.643	0.643	0.00
NB: reduced functional	2.523	2.523	0.00

NB: non- functional	0.599	0.599	0.00
B: functional	n/a	n/a	n/a
B: reduced functional	9.302	9.302	0.00
B: non- functional	n/a	n/a	n/a

B: Blocked; NB: Not blocked n/a: not applicable

[1] High bog drainage for the 2004/05 maps has been revised (e.g. re-digitised in cases) and figures above may vary slightly from those given by Fernandez *et al*. (2005)

Table 6.3 below provides a more detailed description of the drainage present on the high bog at Ballyduff Bog including any change in their functionality in the 2004 – 2011 reporting period (see Map 3).

Table 6.3 High bog drainage detail

Drain Name	Length (km)	2004 status	2011 status	Change	Comment
bA1	0.324	NB: non-functional	NB: non- functional	No	
bA	0.613	B: reduced functional	B: reduced functional	No	Infilling taking place
bA	0.333	NB: reduced functional	NB: reduced functional	No	Infilling taking place
bB	0.801	NB: reduced functional	NB: reduced functional	No	Infilling taking place
bB1	0.274	NB: reduced functional	NB: reduced functional	No	Infilling taking place
bC	0.279	B: reduced functional	B: reduced functional	No	Infilling taking place
bD	0.643	NB: functional	NB: functional	No	
bG	0.081	NB: reduced functional	NB: reduced functional	No	Infilling taking place
bH	0.199	NB: non-functional	NB: non- functional	No	

bK	0.342	NB: reduced functional	NB: reduced functional	No	Infilling taking place
bL	0.411	NB: reduced functional	NB: reduced functional	No	Infilling taking place
bM	0.076	NB: non-functional	NB: non- functional	No	
ND	8.690	B: reduced functional	B: reduced functional	No	Infilling taking place

Bog margin drainage

The cutover areas were not surveyed for drains during 2011.

According to Fernandez *et al*. (2005) several previous surveys mentioned the negative influence of cutover drains along the south and north cutovers, and the area between Ballyduff and Clonfinane Bogs. These drains remain functional and the drain along the south cutover has been deepened in the 2005-2010 period as evidenced by the 2010 aerial photograph. Therefore, some negative influence is still expected. These drains are considered to have a medium importance/impact on high bog habitats.

Fire history

No evidence of fire events were noted during the 2011 survey for the period 2004-2011. The last fire event recorded at the site took place in 1994.

Invasive species

Some scattered scots pine trees (*Pinus sylvestris*) were mentioned by Fernandez *et al*. (2005) report encroaching of the high bog. These trees still remain on the high bog but do not appear to be spreading.

Invasive species are considered to have low intensity/impact on high bog habitats.

Afforestation and forestry management

There are no plantations on the high bog. However, there is a small strip of conifers along the south-western margin of the bog; both on and adjacent to the high bog (Fernandez *et al*., 2005). This are considered to have a low importance/impact on high bog habitats.

Other impacting activities

No other significant impacting activities were noted or recorded in 2011 impacting high bog habitats in the 2004-2011 reporting period.

Conservation activities

A Restoration Project was undertaken in 2003, which included the blocking of the majority of high bog drains. Active Raised Bog (**Sc5** and **C4**) and sub-marginal ecotope have expanded in the 2004-2011 reporting period within drain complex ND, which was blocked as part of the 2003 restoration project. This area was mapped almost entirely as marginal ecotope in 2004.

High bog drainage blocking is reported as a positive management action under Restoring/Improving the hydrological regime (4.2) within table 6.1.

Conservation status assessment

The assessment of the conservation status of Annex I Active and Degraded Raised Bog is based on the following (a more detailed description of conservation status assessment methods is given within the methods section of the project's Summary Report (Volume 1):

AREA - comparison of current habitat area with favourable reference values and its change in the reporting period to assess trends.

STRUCTURE & FUNCTION - comparison of central ecotope and active flush area (i.e. the higher quality wetter vegetation communities) for Active Raised Bog, and marginal and face bank ecotope area (i.e. the lower quality and drier vegetation communities) for Degraded Raised Bog against favourable reference values to assess their status and changes in their area in the reporting period to assess their trend. Community complex descriptions were also taken into account to evaluate changes in ecotope quality together with an analysis of the indicators recorded in the quadrats.

FUTURE PROSPECTS - an assessment of the influence of current and future activities both negative and positive (e.g. restoration works) affecting these habitats. Future Prospects for Active and Degraded Raised Bog are assessed at status and trend level based on the prospects for the habitat to reach favourable reference values in a two reporting period (12 years).

Active Raised Bog (7110)

Area

Table 8.1 indicates that there has been a slight increase (0.58ha) in the area of Active Raised Bog in the 2004-2011 reporting period. This is the result of the expansion of sub-central ecotope within **Sc5** (approx. 0.4ha) and development of new central ecotope (**C4**, 0.18ha) within the blocked drain complex bA, bC and ND, as a result of re-wetting processes after blocking of drains (see Map 1).

C5 and **C6** reported as part of the new 2011 survey are the result of a more comprehensive surveying in 2011. **C1** is much larger (0.29ha) than reported in 2004. This is likely to be, at least partially, a real increase as there are a number of sub-central points recorded in this area in 2004. **C2** now consists of two separate sections of central ecotope. This is the result of more accurate surveying and mapping in 2011. Furthermore, **C1** now has an elongated shape in a NW-SE orientation, which indicates a water flow pattern towards the SE section of the high bog where drains ND are located.

Several new areas of sub-central ecotope (**Sc6** to **Sc8**) have been mapped in 2011. These areas are again the result of more comprehensive surveying in 2011, which also resulted in changes in **Sc1, Sc2** and **Sc3**. **Sc2** and **Sc3** are now mapped as a number of isolated sub-central ecotope patches while **Sc1**'s boundary has been refined. It appears that there may have been a slight expansion of **Sc1** to the south, but this is uncertain. Furthermore, **Sc2** is now deemed to be complex 10/4. This is the result of result of re-allocating this area to a different vegetation community complex rather than an actual change.

The favourable reference value (FRV) for area is considered to be the sum of Active Raised Bog (central, sub-central ecotopes and active flush) plus sub-marginal ecotope when the Habitats Directive came into force in 1994 (see table 8.4). Therefore, Active Raised Bog Area FRV is 60.44ha (based on 1994/95 Kelly (1995) figures amended by Fernandez *et al.* (2005), see tables 8.1 and 8.3 below). This FRV is only approximate until further hydrological and topographical studies are carried out in order to assess the maximum potential capacity of the high bog to support Active Raised Bog. The current habitat area value (15.16ha) is 74.92% below the FRV. A current Area value more than 15% below FRV falls into the **Unfavourable Bad** assessment category. Active Raised Bog would not reach a favourable assessment until its Area reaches the FRV.

A long term (1994/5-2011) trend indicates a reduction in the area of Active Raised Bog at the site (2.8ha) (see table 8.1). A more recent and short term trend analysis (7 years; 2004-2011) gives a more

optimistic result with a slight increase (0.68ha) in its area. Therefore, the habitat Area is given an **Increasing** trend assessment.

The Area of Active Raised Bog at Ballyduff Bog is assessed as Unfavourable Bad-Increasing (see table 8.5).

Structure & Functions

The FRV for S&Fs is for at least half of the active raised bog area to be made up of central and active flush, i.e. the higher quality wetter vegetation communities. This value is 7.58ha (half of 15.16ha, the current area of ARB). The current value is 1.29ha which is 82.98% below the FRV. A current value more than 25% below FRV falls into the **Unfavourable Bad** assessment category.

A long term (1994/5-2011) trend indicates a decrease of the area of central ecotope at the site (11.06ha) (see table 8.1). A more recent and short term trend analysis (7 years; 2004-2011) shows a slight increase (0.18ha). Therefore, the habitat's S&Fs are given an **Improving** trend assessment.

Quadrats analysis (**Qc1, Qc2, Qsc1** and **Qsc2**) indicates the following:

Qc1: The complex name of this quadrat has been changed from 10/9/15 in 2004 to 10/15 in 2011. This is largely due to re-classification as *Eriophorum vaginatum* was recorded as 26-33% cover in 2011. The total *Sphagnum* cover (76-90%) has not changed from 2004-2011 and overall the quadrats appear very similar. There has been an increase in the cover of *S. cuspidatum* from 4-10% in 2004 to 26-33% in 2011 and a decrease in the cover of *S. magellanicum* from 11-25% in 2004 to 1-3% in 2011. This may indicate that the area is getting wetter. However, these changes may also merely be the result of lack of precision in relocating of the quadrat (up to 2m) between both year surveys, rather than an actual change. The absence of *S. austinii* in 2011 (it was recorded at 4-10% cover in 2004) may also be due to this possibility.

Qc2: The total *Sphagnum* cover (76-90%) has not changed from 2004-2011 and overall the quadrats appear very similar. There has been a decrease in the cover of *S. cuspidatum* from 51-75% in 2004 to 34-50% in 2011 and an increase in the cover of *S. magellanicum* from 11-25% in 2004 to 26-33% in 2011. This may indicate a slight drying out effect on the area. However, these changes may also merely be the result of lack of precision in relocating of the quadrat (up to 2m) between both year surveys, rather than an actual change.

Qsc1: The complex name of this quadrat has been changed from 10/7/4 in 2004 to 10/9 in 2011. The total *Sphagnum* cover has increased from 51-75% in 2004 to 76-90% in 2011 and along with the increase in cover of *S. magellanicum* from 26-33% in 2004 to 51-75% in 2011, it may indicate that the

area is improving after the blocking of the adjacent drain complex (ND). Furthermore, bare peat and *Narthecium ossifragum* were recorded at 4-10% in 2004 and as absent in 2011. However, on the negative side *S. austinii* was recorded at 4-10% cover and was absent in 2011. This could be the result of lack of precision in relocating of the quadrat, rather than actual change.

Qsc2: The total *Sphagnum* cover (51-75%) has not changed from 2004-2011 and overall the quadrats appear very similar. There has been a slight decrease in the cover of *S. magellanicum* from 11-25% in 2004 to 4-10% in 2011 and an increase in the cover of *Rhynchospora alba* from 4-10% in 2004 to 11-25% in 2011. However, these changes may merely be the result of lack of precision in relocating of the quadrat (up to 2m) between both year surveys, rather than an actual change.

Typical good quality indicators and typical plant species are still found in sub-central and central ecotopes throughout the entire bog. No major changes of their occurrence within quadrats (**Qc1**, **Qc2**, **Qsc1** & **Qsc2**) have taken place (see Appendix III).

The Structure & Functions of Active Raised Bog at Ballyduff Bog are assessed as Unfavourable Bad-Improving (see table 8.5).

Future Prospects

Restoration works undertaken at the site have had positive effects on the habitat as the expansion of sub-central ecotope and development of central ecotope indicates. This are expected to continue in the near future.

Habitat **Area** is currently 74.92% below FRV (see table 8.4) and an Increasing trend is expected in the following two reporting periods (12 years), as a result of the positive effects of restoration works and despite some impacting activities (high bog and cutover drainage) still having a negative influence on the high bog habitats (see table 6.1). Nevertheless the habitat Area is expected to remain more than 15% below FRV. Thus, habitat's **Area Future Prospects** are assessed as **Unfavourable Bad-Increasing**. Habitat's **S&Fs** are currently 82.98% below FRV (see table 8.4). An Improving trend is also foreseen, but the **S&Fs** are expected to be more than 25% below FRV in the following two reporting periods. Thus **S&Fs Future Prospects** are assessed as **Unfavourable Bad-Improving**.

The overall habitat's Future Prospects are Unfavourable Bad-Improving (see table 8.5). Blocking of remaining reduced-functional and functional drains both on the high bog and cutover is recommended.

The overall conservation status of Active Raised Bog at Ballyduff Bog is assessed as Unfavourable Bad-Improving (see table 8.5).

Table 8.1 Changes in Active Raised Bog area

Active Ecotopes	1994/5 [1]	2004 [2]	2004 (amended)	2011	Change (2004-2011)	
	Area (ha)	Area (ha)	Area (ha)	Area (ha)	Area (ha)	%
Central	12.22	0.65	0.98	1.16	(+)0.18	(+)18.37
Sub-central	4.01	11.83	13.47	13.87	(+)0.40	(+)2.97
Active flush	1.81	0.57	0.13	0.13	0.00	0.00
Total	**18.04**	**13.05**	**14.58**	**15.16**	**(+)0.58**	**(+)4.01**

[1] These are the figures calculated from the vegetation map drawn by Kelly *et al*., (1995) that was geo-referenced and digitised as part of Fernandez *et al*. (2005) project.

[2] 2004 figures have been slightly modified based on a more accurately mapped high bog boundary undertaken as part of this project. This has mostly affected face bank ecotope figures.

Note: Table 8.1 includes 2004 figures and 2004 amended figures. The latter shows the ecotope area believed to be present in 2004 after surveying improvements in 2011. The comparison between 2004 (amended) and 2011 illustrates the actual changes in ecotope area in the 2004-2011 period. Any change in ecotope area between the 2004 and the 2004 (amended) values is due to improvement in mapping accuracy and/or the result of a more comprehensive survey in 2011 (see table 8.2 for further detail).

Table 8.2 Assessment of changes in individual Active Raised Bog areas

Area	Quadrats	Trend	Comment	Quadrats analysis
C1	None	Stable possibly expanding	C1 much larger than mapped in 2004. This may be the result of more comprehensive surveying in 2011 which resulted in a more accurate mapping. However, in the 2005 map there are a number of sub-central points (4/6/10) within this expanded area of C1 so it is likely to be, at least partially, a real increase.	
C2	Qc2	Stable	Slight changes as a result of more	Qc2: 2004 and 2011 quadrats are very

			comprehensive surveying in 2011 which resulted in a more accurate mapping.C2 now consists of two separate central ecotope sections.	similar. Slight decrease in cover of *Sphagnum cuspidatum* and a slight increase in cover of *S. magellanicum*,
C3	Qc1	Stable possibly improving	Slight changes as a result of more comprehensive surveying in 2011 which resulted in a more accurate mapping.	Qc1: Reduction in cover of *Sphagnum magellanicum* and in *Sphagnum* lawns and an increase in cover of *S. cuspidatum* and *Sphagnum* pools.
C4	None	Newly developed	This central ecotope section has developed as a result of re-wetting associated with blocking of drainage. Sections of C4 were previously mapped as Sc5.	
C5	None	Stable	This specific area was not surveyed in 2004. This is likely to be due to more comprehensive surveying in 2011, which resulted in a more accurate mapping.	
C6	None	Stable	This specific area was not surveyed in 2004. Thus any ecotope map changes here are due to more comprehensive surveying in 2011, which resulted in a more accurate mapping.	
Sc1	Qsc2	Stable (possibly expanding)	Slight changes along this sub-central section's boundary as a result of more comprehensive surveying in 2011, which resulted in a more accurate mapping. It does appear, however, that there may have been a slight expansion of **Sc1** to the south, but this is uncertain.	Qsc2: 2004 and 2011 quadrats are very similar. There has been a slight decrease in the cover of *S. magellanicum* from 11-25% in 2004 to 4-10% in 2011 and an increase in the cover of *Rhynchospora alba* from 4-10% in 2004 to 11-25% in 2011.
Sc2	None	Stable	This sub-central ecotope section currently consists of two separate patches, with an overall area smaller than reported in 2004. Some isolated small sub-central patches (too small to be mapped) also reported within former Sc2.The decrease in area is due to more comprehensive	

			surveying in 2011, which resulted in more accurate mapping.	
Sc3	None	Stable	This sub-central ecotope section currently consists of three separate patches, with an overall area smaller than reported in 2004. This is due to more comprehensive surveying in 2011, which resulted in more accurate mapping.	
Sc4	None	Stable	Slight changes along the southern section of Sc4 as a result of more comprehensive surveying in 2011, which resulted in a more accurate mapping.	
Sc5	Qsc1	Increasing	This sub-central ecotope section has expanded as a result of re-wetting associated with blocking of drainage. C4 has developed also within a section previously mapped as Sc5. Northern section of Sc5 was previously mapped as FZ (active flush). FZ now allocated to sub-central ecotope.	Qsc1: The total *Sphagnum* cover has increased from 51-75% in 2004 to 76-90% in 2011 and along with the increase in cover of *S. magellanicum* from 26-33% in 2004 to 51-75% in 2011, it may indicate that the area is improving after the blocking of the adjacent drain complex (ND). Furthermore, bare peat and *Narthecium ossifragum* were recorded at 4-10% in 2004 and as absent in 2011. However, on the negative side *S. austinii* was recorded at 4-10% cover and was absent in 2011
Sc6	None	Stable	This specific area was not surveyed in 2004. It consists of five isolated patches of sub-central ecotope located on depressions in the ground. Any ecotope map changes here are due to more comprehensive surveying in 2011, which resulted in a more accurate mapping.	
Sc7	None	Unknown	This specific area was not surveyed in 2004. Thus any ecotope map changes here are due to more comprehensive	

			surveying in 2011, which resulted in a more accurate mapping.
Sc8	None	Unknown	This specific area was not surveyed in 2004. Thus any ecotope map changes here are due to more comprehensive surveying in 2011, which resulted in a more accurate mapping.
FY	None	Stable	This active flush is much smaller than mapped in 2004. This is the result of re-allocating the largest section of FY to sub-central ecotope in 2011. FY now consists of two separated flushes.
FZ	None	Re-wetting	Slight changes in boundary. This is likely to be due to more comprehensive surveying in 2011, which resulted in more accurate mapping. This area and that surrounding Sc5 are re-wetting.

Degraded Raised Bog (7120)

Area

The Degraded Raised Bog FRV for area is 26.23ha at Ballyduff Bog. This value corresponds with the difference between the current high bog area (86.67ha) and Active Raised Bog FRV (60.44ha) for area. Degraded Raised Bog is a particular habitat type, for which a FRV smaller than the current value, may be desirable in many sites. However any decrease in habitat area would only be considered positive, when it is the result of restoration to Active Raised Bog. Current habitat Area is 172.63% bigger than FRV and therefore the habitat Area is given an **Unfavourable Bad** assessment (see table 8.4).

Table 8.3 indicates that there has been a decrease (0.61ha) in the area of Degraded Raised Bog. 0.58ha correspond to newly developed Active Raised Bog, which should be taken as a positive trend, whereas 0.03ha correspond with Degraded Raised bog (face bank) lost as a result of peat cutting. Therefore the habitat is given a **Decreasing** trend.

The Area of Degraded Raised Bog at Ballyduff Bog is assessed as Unfavourable Bad-Decreasing (see table 8.5).

Structure & Functions

The FRV for S&Fs is for a maximum 25% of the Degraded Raised Bog area to be made up of marginal and face bank, i.e. the lower quality and drier vegetation communities. This value is 17.88ha (25% of 71.51ha, the current area of Degraded Raised Bog). The current marginal and face bank ecotopes area value (26.45ha) is 47.76% above the FRV (in the particular case of Degraded Raised Bog a current area value equal or smaller than FRV is desirable) (see Table 8.4). A current value more than 25% above FRV falls into the **Unfavourable Bad** assessment category.

S&Fs trend is assessed based on actual changes within marginal and face banks ecotope (e.g. decreases due to rewetting processes or increases as a result of further drying out). As table 8.3 indicates, the area of marginal ecotope has decreased by 0.58ha as a result of increases in sub-central and central ecotope. Sub-marginal ecotope has expanded (approx. 6ha) along the south-eastern section of high bog where drains bA, bC and ND were blocked and re-wetting is taking place. Thus, the DRB's S&Fs at Ballyduff Bog are given an **Improving** trend.

The Structure & functions of Degraded Raised Bog at Ballyduff Bog are assessed as Unfavourable Bad-Improving (see table 8.5).

Future Prospects

Restoration works undertaken at the site have had positive effects on the habitat as the expansion of sub-marginal ecotope indicates. These are expected to continue in the following two reporting periods (12 years). Habitat **Area** is currently 172.63% above FRV (see table 8.4) and a Decreasing trend is expected in the following two reporting periods. Habitat Area is expected to remain more than 15% above FRV. Thus, habitat's **Area Future Prospects** are assessed as **Unfavourable Bad-Decreasing**. Habitat's **S&Fs** are currently 47.76% above FRV (see table 8.4). Although an Improving trend is foreseen in the following two reporting periods, **S&Fs** are expected to remain more than 25% above FRV. Thus, habitat's **S&Fs Future Prospects** are assessed as **Unfavourable Bad-Improving**.

The Future Prospects for Degraded Raised Bog are considered Unfavourable Bad-Improving (see table 8.5) as a result of the positive effects of restoration works, despite some impacting activities (peat cutting, high bog and cutover drainage) still having a negative influence on the high bog habitats (see table 6.1).

The overall conservation status of Degraded Raised Bog at Ballyduff Bog is assessed as Unfavourable Bad-Improving (see table 8.5).

Table 8.3 Changes in Degraded Raised Bog area

Inactive Ecotopes	**1994/5** [1]	**2004** [2]	**2004 (amended)**	**2011**	**Change (2004-2011)**	
	Area (ha)	**Area (ha)**	**Area (ha)**	**Area (ha)**	**Area (ha)**	**%**
Sub-marginal	42.40	31.57	39.07	45.07	(+)6.00	(+)15.36
Marginal	30.27	39.52	30.45	23.87	(-)6.58	(-)21.61
Inactive flush	0.00	0.00	0.03	0.03	0.00	0.00
Face bank	na	2.58	2.58	2.55	(-)0.03	(-)1.16
Total	**72.67**	**73.67**	**72.13**	**71.52**	**(-)0.61**	**(-)0.86**

[1] These are the figures calculated from the vegetation map drawn by Kelly *et al.,* (1995) that was geo-referenced and digitised as part of Fernandez *et al*. (2005) project.

[2] 2004 figures have been slightly modified based on a more accurately mapped high bog boundary undertaken as part of this project. This has mostly affected face bank ecotope figures.

Note: Table 8.3 includes 2004 figures and 2004 amended figures. The latter shows the ecotope area believed to be present in 2004 after surveying improvements in 2011. The comparison between 2004 (amended) and 2011 illustrates the actual changes in ecotope area in the 2004-2011 period. Any change in ecotope area between the 2004 and the 2004 (amended) values is due to improvement in mapping accuracy and/or the result of a more comprehensive survey in 2011.

Depressions on peat substrates of the Rhynchosporion (7150)

Rhynchospora alba depressions are found across the entire bog in both Active and Degraded Raised Bog. The species is more frequently found and reaches its finest quality associated within wet features (*Sphagnum* pools, lawns and hollows) on Active Raised Bog.

The physical structure and distribution of the habitat across large sections of the high bog makes the process of calculating its area unfeasible and as a consequence makes the process of calculating realistic FRVs unfeasible. Thus, the assessment of the habitat's Area conservation status is indirectly based on the assessment of Active Raised Bog habitat Area (a favourable assessment indicates that

all sub-marginal ecotope has turned Active Raised Bog). The habitat Area is given an **Unfavourable Bad** assessment.

The Area trend assessment is based on the variation on Active Raised Bog and sub-marginal ecotope within Degraded Raised Bog in the reporting period. The area of Active Raised Bog and sub-marginal ecotope has increased in the reporting period. As result habitat Area is given an **Increasing** trend.

The habitat's Area Future Prospects status is equally based on the Active Raised Bog Area Future Prospects status assessment and the Area Future Prospects trend is based on the trend expected for Active Raised Bog and sub-marginal ecotope in the following two reporting periods. Restoration works are likely to continue to positively affect the habitat in the future despite the occurrence of certain activities (e.g. high bog and cutover drainage) still negatively impacting the associated habitats (i.e. Active and Degraded Raised Bog). Therefore, the habitat's Area Future Prospects are given an **Unfavourable Bad-Increasing** assessment.

The S&Fs conservation assessment is also indirectly based on the Active Raised Bog S&Fs status and trend assessments, as Active Raised Bog supports the finest habitat quality type. Therefore, the habitat's S&Fs are given an **Unfavourable Bad-Improving** assessment.

The habitat's S&Fs Future Prospects status and trend are equally based on the Active Raised Bog S&Fs Future Prospects status and trend assessments in the following two reporting periods. Therefore, the habitat's S&Fs Future Prospects are given an **Unfavourable Bad-Improving** assessment.

The overall habitat's Future Prospects assessment is Unfavourable Bad-Improving.

The conservation status of depressions on peat substrates of the Rhynchosporion at Ballyduff Bog is assessed as Unfavourable Bad-Improving (see table 8.5).

Table 8.4 Habitats favourable reference values

Habitat	Area Assessment			Structure & Functions Assessment		
	FRV Target (ha) [1]	2011 value (ha) [2]	% below target	FRV Target for 2011 (ha)[3]	2011 value (ha) [4]	% below target
7110	60.44	15.16	74.92	7.58	1.29	82.98

[1] 1994/5 central, sub-central, active flush, bog woodland and sub-marginal ecotope area.

[2] 2011 central, sub-central ecotope, active flush and bog woodland area.

[3] Half of the current central, sub-central ecotope and active flush area. The target is that the area of the highest vegetation quality (i.e. central ecotope and active flush) should be at least this figure.

[4] 2011 central ecotope and active flush area.

	FRV Target (ha) [5]	2011 value (ha) [6]	% above target	FRV 2011 Target (ha) [7]	2011 value (ha) [8]	% above target
7120	26.23	71.51	172.63	17.88	26.45	47.76

[5] 1994/5 high bog area minus 7110 area FRV.

[6] 2011 Degraded Raised Bog area.

[7] 25% of the current Degraded Raised Bog habitat area. The target is that the extent of marginal and face bank ecotopes should not be larger than 25% of the current Degraded Raised Bog habitat area.

[8] Current marginal and face bank ecotopes area.

As table 8.5 below indicates, each individual EU habitat present on the high bog has been given the following overall conservation status assessment based on the three main parameters (Area, S&Fs and Future Prospects) individual assessments:

- **Active Raised Bog is assessed as being Unfavourable Bad–Improving.**
- **Degraded Raised Bog is assessed as being Unfavourable Bad–Improving.**
- **Rhynchosporion depressions habitat is assessed as being Unfavourable Bad–Improving.**

Table 8.5 Habitats conservation status assessments

Habitat	Area Assessment	Structure & Functions Assessment	Future Prospects Assessment	Overall Assessment
7110	Unfavourable Bad-Increasing	Unfavourable Bad-Improving	Unfavourable Bad-Improving	Unfavourable Bad-Improving
7120	Unfavourable Bad-Decreasing	Unfavourable Bad-Improving	Unfavourable Bad-Improving	Unfavourable Bad-Improving
7150	Unfavourable Bad-Increasing	Unfavourable Bad-Improving	Unfavourable Bad-Improving	Unfavourable Bad-Improving

Conclusions

Summary of impacting activities

- Peat cutting is no longer present at the site. However, open face banks may still continue draining the high bog.
- Only a few drains on the high bog remain functional (drain complex bD in the east at the edge of the high bog). Overall high bog drains have continued infilling.
- Cutover drainage (peripheral drainage) continues impacting on high bog vegetation (the drain along the southern cutover was deepened in the 2005-10 period).
- No fire events have damaged the high bog in the reporting period.
- Invasive species (*Pinus sylvestris*) although present do not appear to have spread in the reporting period and are thus not considered a major threat.

Changes on active peat forming areas

- Three new peat forming areas (**Sc6**, **Sc7/C6** and **Sc8**) have been described at the site (see table 8.2). These new sub-central and central ecotope areas are likely to be the result of improvements on mapping accuracy rather than actual changes on Active Raised Bog.
- Active Raised Bog has expanded in the area of **Sc5** at the north-east of the blocked drainage complex ND. The quality of the vegetation is also improving in this area with a newly developed area of central ecotope (**C4**) described here in 2011.
- There are indications in parts of the high bog that the quality of active raised bog is improving (**C1**, **C3** & **C5**).

Other changes

- The new ecotope map (Map 1) shows a flush Y (FY) as being much smaller than in 2004. This is due to the re-classification of much of this flush as sub-central ecotope.

Quadrats analysis

- No major changes in vegetation have taken place within those quadrats recorded in 2004 that were re-surveyed in 2011 (see Appendix III). However, there are slight indications that the vegetation in **Qc1** (increase in cover of *Sphagnum cuspidatum*) and **Qsc1** (increase in total *Sphagnum* cover) may be improving.

- Although high accuracy GPS equipment was used during the 2004 and 2011 surveys, the devises still only allow up to 0.5m accuracy. The lack of precision in relocating of the quadrat may justify certain differences in the vegetation described.

Restoration works

- Restoration works (blocking of high bog drainage) continue to have a positive effect on the high bog vegetation. Infilling processes continue in the blocked drains and the blocking of drain complex ND has triggered the formation of a new peat forming area (**SC5** and **C4**).

Summary of conservation status

- **Active Raised Bog** has been given an overall **Unfavourable Bad-Improving** conservation status at Ballyduff Bog. Habitat Area and quality have Increased and Improved in the reporting period, but both are below reference values. Future Prospects are considered Unfavourable Bad-Improving.
- **Degraded Raised Bog** has been given an overall **Unfavourable Bad-Improving** conservation status at Ballyduff Bog. Habitat Area has decreased due to an increase of Active Raised Bog and small losses because of peat cutting, and quality has improved in the reporting period. Future Prospects are considered Unfavourable Bad-Improving.
- **Depressions on peat substrates of the Rhynchosporion** has been given an overall **Unfavourable Bad-Improving** conservation status at Ballyduff Bog. Habitat Area and quality have Increased and Improved in the reporting period. Future Prospects are considered Unfavourable Bad-Improving.

The **conservation status** of the **overall raised bog** at **Ballyduff SAC** is assessed as being **Unfavourable Bad-Improving**.

Recommendations

- **Further restoration works** including the blocking of any remaining high bog reduced functional drains, and possibly the cutover drains.
- **Further hydrological and topographical studies** to ascertain the capacity of the high bog to support Active Raised Bog and thus estimate a more accurate favourable reference value.
- **Further botanical monitoring surveys** both on the high bog and cutover in order to assess the effectiveness of restoration works.
- **An Impact assessment** of maintenance works on adjacent land drainage with a view to the potential of blocking these drains.

References

Cross, J. R. 1990. *The Raised Bogs of Ireland: their Ecology, Status and Conservation*. Report to the Minister of State at the Department of Finance.

Fernandez, F., Fanning, M., McCorry, M. and Crowley, W. 2005. *Raised Bog Monitoring Project 2004-05*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.

Kelly, L., Doak, M. and Dromey, M. 1995. *Raised Bog Restoration Project: An Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland*. Unpublished report, National Parks & Wildlife, Department of Environment, Heritage and Local Government, Dublin.

Appendix I Detailed vegetation description of the high bog

Active Raised Bog (7110)

Central Ecotope Complexes

COMPLEX 10/15

- **Location**: found dominating all six sections (**C1** to **C6**) of central ecotope within the site
- **Ground**: quaking
- **Physical indicators**: absent
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: depression
- **Pools**: interconnecting pools 11-25% (mostly *Sphagnum*-filled but also with open water)
- ***Sphagnum* cover**: >90%
- ***Narthecium* cover**: <4%
- **Micro- topography**: *Calluna vulgaris* hummocks /low hummocks/*Sphagnum* lawns/ pools.
- **Tussocks**: absent
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (11-25%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (26-33%), *E. angustifolium* (<4%), *Narthecium ossifragum* (<4%), *Rhynchospora alba* (<4%), *Andromeda polifolia* (<1%), *Drosera rotundifolia* (<1%), *D. anglica* (<1%), *Menyanthes trifoliata* (<1%), *Sphagnum capillifolium* (H; 11-25%), *S. papillosum* (H& L; 11-25%), *S. magellanicum* (H& L; 11-25%), *S. subnitens* var. *subnitens* (H; <4%), *S. austinii* (active H; 4-10%), *S. cuspidatum* (P; 11-25%), *S. recurvum* (P; 4-10%).
- **Additional comments**: **C1** features large *Sphagnum cuspidatum* interconnecting pools as well as *S. papillosum* and *S. magellanicum* hummocks and lawns at the edges of the pools, which contain *Menyanthes trifoliata* and *Rhynchospora alba* (4-10%). *Sphagnum austinii* and *S. fuscum* large hummocks are also present. The overall *Sphagnum* cover within **C1** is 50 to 75%, but there are some patches of sub-central ecotope, where the *Sphagnum* cover decreases and *R. alba* increases.

C2 consists of large *Sphagnum cuspidatum* pools with abundant *Rhynchospora alba* and *Menyanthes trifoliata*. *Sphagnum magellanicum, S. denticulatum* are found in lawns along with *Drosera anglica*.

A new central ecotope section (**C3)** was also found in an area not surveyed in 2004/05. This is a narrow elongated patch (10-15m wide) of central ecotope where there are less pools (4-10%), a *Sphagnum* cover of 76-90% and more tussocks of *Eriophorum vaginatum* (34-50%), less *Calluna vulgaris* (<4%), more *Sphagnum cuspidatum* (L & P; 51-75%), less *S. magellanicum* (L & P; 4-10%) and less *S. capillifolium* (H; <4%). *S. austinii* and *S. fuscum* hummocks are also present. The ecotope quality decreases at the edge of this central section as it grades into sub-central ecotope, where bare peat and algae are found in the pools and the *R. alba* cover increases.

Quadrats **Qc1** and **Qc2** were recorded within this complex at **C3** and **C2**.

Sub-Central Ecotope Complexes

COMPLEX 10/9

- **Location**: found along western section of **Sc1** and dominating **Sc3, Sc4, Sc5** and **Sc6**
- **Ground**: very soft
- **Physical indicators**: absent
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: absent
- **Macro-topography**: depression
- **Pools**: absent
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: <4%
- **Micro- topography**: low hummocks/hollows
- **Tussocks**: *Eriophorum vaginatum* (26-33%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (34-50%), *Erica tetralix* (<4%), *Eriophorum vaginatum* (26-33%), *E. angustifolium* (<4%),*Narthecium ossifragum* (<4%), *Rhynchospora alba* (<4%), *Andromeda polifolia* (<1%), *Drosera rotundifolia* (<1%), *Sphagnum capillifolium* (H; 26-33%), *S. papillosum* (H; <4%), *S. tenellum* (H; <4%), *S. magellanicum* (H; 26-33%), *S. cuspidatum* (Hl; <4%).
- **Additional comments**: This complex dominates **Sc3** and is characterised by abundant *Eriophorum vaginatum* (25-33%), *Calluna vulgaris* (11-25%, *Sphagnum magellanicum* hummocks and *S. cuspidatum* hollows.

This complex is found in a new sub-central ecotope area (**Sc7**) on the northern section of the high bog which was not previously surveyed. The area is slightly depressed and abundant *Eriophorum vaginatum* (25-33%) and *Erica tetralix* (4-10%) characterise this complex. *Sphagnum papillosum* and *S. magellanicum* hummocks are also found, as well as *S. cuspidatum* dominated hollows. *Leucobryum glaucum* was also recorded. Central section (**C6**) of this sub-central area was deemed to be central ecotope (complex 10/15).

Complex 10/9 is again found in two small depressions (**Sc6**) on the ground along the northern section of high bog (GR 203807 / 200561). These two sections may be hydrologically connected and some sort of water flow may take place between them and towards the SW.

This complex (10/9) also dominates some sections of the NW lobe of **Sc1**. Here *Sphagnum cuspidatum* dominates hollows and *S. papillosum, S. magellanicum* and *S. capillifolium* are found forming hummocks. *Eriophorum vaginatum* is abundant (25-33%) along with frequent *Erica tetralix* (4-10%). The overall *Sphagnum* cover ranges from 50 to 75%.

South west section of **Sc1** is also characterised by complex 10/9 (GR 203504 / 200318). This area was not comprehensively surveyed in 2004. *Sphagnum* cover is 50 to 75%. Large *Calluna vulgaris* and *Sphagnum capillifolium* hummocks are found. *Sphagnum papillosum* and *S. magellanicum* were also found forming hummocks. Hollows consist of *S. cuspidatum* and *Rhynchospora alba.* Complex 10/9 at this particular location has a high *R. alba* cover and thus this complex shares features with complex 10/4 also found on Ballyduff Bog.

Eriophorum angustifolium becomes abundant in a small very wet section to the east of **Sc5** and the complex is named 10/9a.

Quadrat **Qsc1** was recorded within this complex at **Sc5**.

COMPLEX 10/4

- **Location**: found dominating **Sc2, Sc8** and the largest portion of **Sc1**
- **Ground**: very soft
- **Physical indicators**: bare peat present in places (<4%)
- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: depression
- **Pools**: absent
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: <4%
- **Micro- topography**: low hummocks/lawns/hollows

- **Tussocks**: *Eriophorum vaginatum* (11-25%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (11-25%), *Erica tetralix* (<4%), *Eriophorum vaginatum* (11-25%), *E. angustifolium* (<4%), *Rhynchospora alba* (11-25%), *Narthecium ossifragum* (<4%), *Drosera anglica* (<1%), *Andromeda polifolia* (<1%), *Sphagnum capillifolium* (H; 26-33%), *S. papillosum* (H; 4-10%), *S. tenellum* (H; <4%), *S. fuscum* (H; <4%), *S. austinii* (H; <4%), *S. magellanicum* (H & L; 4-10%), *S. cuspidatum* (P; <4%).
- **Additional comments**: In the central part of the bog (**Sc1**), there are tall *Calluna vulgaris.* Hummocks with *Sphagnum capillifolium* and *S. papillosum* and pools that contain *S. denticulatum* and *S. cuspidatum* but also contain bare peat and *Rhynchospora alba* (203474/200890). In some areas there is a better cover of active *S. austinii* hummocks (up to 4-10% cover in places). *Menyanthes trifoliata* is also present.

  Complex 10/4 dominates **Sc2**. This is the result of re-allocating this area to a different vegetation community complex rather than an actual change.

Quadrat **Qsc2** was recorded within this complex at **Sc1**.

COMPLEX 9/7/10

- **Location**: found dominating **Sc4**, but also within **Sc1** and **Sc3**
- **Ground**: Soft
- **Physical indicators**: bare peat present in places (<4%)
- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: Flat/gentle slope
- **Pools**: absent
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: 4-10%
- **Micro- topography**: high hummocks/hollows
- **Tussocks**: *Eriophorum vaginatum* (11-25%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (25-33%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (11-25%), *E. angustifolium* (<4%), *Rhynchospora alba* (4-10%), *Narthecium ossifragum* (4-10%), *Andromeda polifolia* (<1%), *Sphagnum capillifolium* (H; 26-33%), *S. papillosum* (H; 4-10%), *S. tenellum* (H; <4%), *S. fuscum* (H; <4%), *S. austinii* (H; <4%), *S. magellanicum* (H & L; 4-10%), *S. cuspidatum* (P; <4%).

- **Additional comments**: None

Active Flushes

FLUSH Y

- **Location**: eastern high bog section; to the south of **C2**
- **Ground**: soft
- **Physical indicators**: absent
- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: not available
- **Macro-topography**: flat
- **Pools**: absent
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: not available
- **Micro- topography**: hummocks/hollows
- **Tussocks**: not available
- **Degradation or regeneration evidence**: absent
- **Species cover**: not available
- **Additional comments:** flush Y consists of two isolated wooded flushes. The second flush consists of two *Betula pubescens* trees (<30 tall) and one *Pinus sylvestris* (<2m). The ground consists of *Sphagnum capillifolium* and *S. magellanicum* hummocks and *S. cuspidatum* hollows. *Aulacomnium palustre* is also found and *Calluna vulgaris* height is up to 50cm.

FLUSH Z (ACTIVE SECTION)

- **Location**: southeast high bog; to the north of **C4**
- **Ground**: soft
- **Physical indicators**: absent
- ***Calluna* height**: 61-70cm
- ***Cladonia* cover**: Absent
- **Macro-topography**: Flat
- **Pools**: Absent
- ***Sphagnum* cover**: 34-50%
- ***Narthecium* cover**: Absent
- **Micro- topography**: *Calluna* hummocks

- **Tussocks**: *Eriophorum vaginatum* tussocks
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (25-33%), *Erica tetralix* (<4%), *Myrica gale* (4-10%), *E. vaginatum* (25-33%), *Sphagnum capillifolium* (11-25%), *S. papillosum* (11-25%), *S. palustre* (11-25%), *Vaccinium oxycoccos, Aulacomnium palustre*. *Pinus sylvestris* (3m) but mostly 1.5m and one *Betula pubescens* (2-2.5m).
- **Additional comments:** the north-eastern part of the flush is drier and inactive.

Degraded Raised Bog (7120)

Sub-Marginal Ecotope Complexes

COMPLEX 9/7

- **Location**: dominating blocked drain complex ND to southeast, but also found to the east and west of high bog
- **Ground**: soft
- **Physical indicators**: bare peat particularly at the edges of the complex (11-25%)
- ***Calluna* height**: <30cm
- ***Cladonia* cover**: 4-10%
- **Macro-topography**: depression
- **Pools**: open water pools created in areas where peat was extracted to build dams (11-25%)
- ***Sphagnum* cover**: 11-25%; although *Sphagnum* cover is higher (50-75%) in smaller patches particularly near blocked drains
- ***Narthecium* cover**: <4%
- **Micro-topography**: low hummocks/*Eriophorum vaginatum* tussocks/open water pools/ hollows
- **Tussocks**: *Eriophorum vaginatum* (33-50%)
- **Degradation or regeneration evidence**: rewetting
- **Species cover**: *Calluna vulgaris* (4-10%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (33-50%), *E. angustifolium* (4-10%), *Narthecium ossifragum* (<4%), *Rhynchospora alba* (4-10%), *Sphagnum capillifolium* (H; 4-10%), *S. papillosum* (H; 4-10%), *S. magellanicum* (H; 4-10%), *S. cuspidatum* (P; 4-10%)
- **Additional comments:** area rewetting, open water pools near dams or adjacent to drains. Large sections of drainage network ND are completely waterlogged and dominated by this complex, which is likely evolve to active peat forming vegetation in the near future. Where *Narthecium ossifragum* or *Carex panicea* become abundant the complex is named 9/7/6 or 9/7/3

respectively. Where *Myrica gale* and *Narthecium ossifragum* become abundant the complex is named 9/7/6+My

COMPLEX 7/6

- **Location**: eastern section of high bog between **C3** and **C4**
- **Ground**: firm to soft
- **Physical indicators**: bare peat <4%
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: gentle slope inwards towards centre of high bog
- **Pools**: absent
- ***Sphagnum* cover**: 4-10%
- ***Narthecium* cover**: 11-25%
- **Micro-topography**: *Calluna vulgaris* hummocks/*Narthecium ossifragum* hollows
- **Tussocks**: absent
- **Degradation or regeneration evidence**: none
- **Species cover**: *Calluna vulgaris* (26-33%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (<4%), *E. angustifolium*(<4%), *Rhynchospora alba* (4-10%), *Narthecium ossifragum* (11-25%), *Andromeda polifolia* (<1%), *Drosera rotundifolia* (<1%), *Sphagnum capillifolium* (H; 4-10%), *S. papillosum* (H; <4%), *S. tenellum* (H; <4%), *S. subnitens* var. *subnitens* (H; <4%).
- **Additional comments:** where *Rhynchospora alba* becomes more abundant (11-25%) the complex is named 7/6/4; where *Myrica gale* becomes abundant the complex is named 7/6+My.

Marginal Ecotope Complexes

COMPLEX 9/2

- **Location**: southeast within ND
- **Ground**: firm
- **Physical indicators**: bare peat <4%
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: steep slope towards high bog edge
- **Pools**: absent, apart from where peat has been excavated to build dams
- ***Sphagnum* cover**: 4-10%

- ***Narthecium* cover**: <4%
- **Micro-topography**: *Flats*
- **Tussocks**: *Eriophorum vaginatum* (11-25%); *Trichophorum germanicum* (4-10%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (11-25%), *Erica tetralix* (<4%), *Eriophorum vaginatum* (11-25%), *E. angustifolium* (4-10%), *Narthecium ossifragum* (<4%), *Trichophorum germanicum* (4-10%), *Andromeda polifolia* (<1%), *Drosera rotundifolia* (<1%), *Sphagnum capillifolium* (H; <4%), *S. tenellum* (H; <4%), *S. subnitens* var. *subnitens* (H; <4%), *Hypnum jutlandicum* (4-10%).
- **Additional comments**: none

COMPLEX 9 + BARE PEAT

- **Location**: southeast within ND
- **Ground**: firm
- **Physical indicators**: bare peat 11-25%, *Campylopus introflexus* 11-25%
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: gentle slope towards high bog edge
- **Pools**: absent, apart from where peat has been excavated to build dams
- ***Sphagnum* cover**: 4-10%
- ***Narthecium* cover**: <4%
- **Micro-topography**: *Flats*
- **Tussocks**: *Eriophorum vaginatum* (11-25%); *Trichophorum germanicum* (<4%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (4-10%), *Erica tetralix* (<4%), *Eriophorum vaginatum* (11-25%), *E. angustifolium* (4-10%), *Narthecium ossifragum* (<4%), *Trichophorum germanicum* (<4%), *Andromeda polifolia* (<1%), *Drosera rotundifolia* (<1%), *Sphagnum capillifolium* (H; <4%), *S. tenellum* (H; <4%), *S. subnitens* var. *subnitens* (H; <4%).
- **Additional comments**: none

COMPLEX 6/7

- **Location**: found dominating the largest portion of marginal ecotope across entire high bog
- **Ground**: firm
- **Physical indicators**: absent
- ***Calluna* height**: 30-40cm

- ***Cladonia* cover**: 33-50%
- **Macro-topography**: gentle slope
- **Pools**: absent
- ***Sphagnum* cover**: <4%
- ***Narthecium* cover**: 25-33%
- **Micro-topography**: *Calluna vulgaris* hummocks/low hummocks/hollows
- **Tussocks**: absent
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (33-50%), *Erica tetralix* (<4%), *Eriophorum vaginatum* (<4%), *E. angustifolium* (<4%), *Carex panicea* (<4%), *Narthecium ossifragum* (25-33%), *Sphagnum capillifolium* (H; <4%), *S. tenellum* (H; <4%), *S. subnitens* var. *subnitens* (H; <4%), *S. papillosum* (H; <4%), *Leucobryum glaucum* (<1%).
- **Additional comments**: where *Myrica gale* becomes abundant the complex is named 6/7+My

COMPLEX 7/2

- **Location**: found mostly at the edge of high bog along the western, northern and eastern sections
- **Ground**: firm
- **Physical indicators**: bare peat <4%, *Campylopus introflexus* 4-10%
- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: steep slope towards high bog edge
- **Pools**: absent, apart from where peat has been excavated to build dams
- ***Sphagnum* cover**: 4-10%
- ***Narthecium* cover**: 4-10%
- **Micro-topography**: *Calluna vulgaris* hummocks/*Narthecium ossifragum* hollows
- **Tussocks**: *Trichophorum germanicum* (4-10%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (34-50%), *Erica tetralix* (<4%), *Eriophorum vaginatum* (<4%), *E. angustifolium* (<4%), *Narthecium ossifragum* (4-10%), *Trichophorum germanicum* (4-10%), *Andromeda polifolia* (<1%), *Drosera rotundifolia* (<1%), *Sphagnum capillifolium* (H; <4%), *S. tenellum* (H; <4%), *S. subnitens* var. *subnitens* (H; <4%), *Hypnum jutlandicum* (11-25%).
- **Additional comments**: none

Face bank Complexes

COMPLEX 1

- **Location**: this complex was found along the bog margin
- **Ground**: firm
- **Physical indicators**: bare peat variable
- ***Calluna* height**: <50cm
- ***Cladonia* cover**: 4-10%
- **Macro-topography**: steep slope
- **Pools**: absent
- ***Sphagnum* cover**: generally absent but <5% in places
- ***Narthecium* cover**: absent
- **Micro- topography**: absent
- **Tussocks**: absent
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (76-90%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (<4%), *E. angustifolium* (<4%), *Molinia caerulea* (<4%), *Trichophorum germanicum* (<1%), *Myrica gale* (<4%), *Hypnum jutlandicum* (<4%), *Hylocomium splendens* (<1%).
- **Additional comments**: none

Inactive Flushes

FLUSH Z (INACTIVE SECTION)

- **Location**: southeast section of the bog; to the north of **C4**
- **Ground**: soft
- **Physical indicators**: bare peat <4%
- ***Calluna* height**: 41-50cm
- ***Cladonia* cover**: absent
- **Macro-topography**: gentle slope
- **Pools**: absent
- ***Sphagnum* cover**: 11-25%
- ***Narthecium* cover**: 4-10%
- **Micro- topography**: *Calluna vulgaris* hummocks
- **Tussocks**: na

- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (51-75%), *Erica tetralix* (<4%), *Myrica gale* (11-25%), *E. vaginatum* (4-10%), *Sphagnum capillifolium* (11-25%).
- **Additional comments**: although all of flush Z was mapped as active in 2004, it was described as being "mostly active". Thus this inactive section is likely to have also been present at that time.

Depressions on peat substrates of the Rhynchosporion (7150)

The habitat occurs at Ballyduff Bog in both Active and Degraded Raised Bog, but it is only occasional found on degraded habitat. Only *Rhynchospora alba* was recorded within the 2011 survey at this site.

R. alba is found in all ecotopes except the face bank in Ballyduff Bog, such as: central ecotope (complex 10/15); sub-central ecotope (10/9; 10/4; 9/7/10); sub-marginal ecotope (9/7; 7/6) and marginal ecotope (7+BP).

The species becomes very frequent within complex 10/4 (sub-central ecotope) where it reaches cover values of 11-25%. However, the *R. alba* here is colonising depressions that would appear to have once been *Sphagnum* pools/lawns, and is thus apparently an indicator of degradation in this part of Ballyduff Bog.

The species is always found associated with wet features such as *Sphagnum* pools, *Sphagnum* lawns and hollows, along with *Sphagnum magellanicum*, *S. papillosum*, *S. cuspidatum*. It was also found within *Narthecium ossifragum* dominated hollows in sub-marginal ecotope complexes.

Appendix II Photographical records

Photograph Number	Aspect	Type	Feature	Date
102-0446	SW	Overview	Qsc1	13/09/2011
102-0447	S	Overview	Qc1	13/09/2011
102-0448	E	Overview	Qsc2	13/09/2011
102-0449	E	Overview	Qc2	13/09/2011

Appendix III Quadrats

Ecotope type	**Central**	**Central**	**Central**	**Central**
Complex Name	**10/9/15**	**10/15**	**10/15**	**10/15**
Quadrat Name	Qc1	Qc1	Qc2	Qc2
Easting	200945	200946	200857	200863
Northing	203466	203468	203507	203503
Firmness	Quaking	Very soft	Quaking	Quaking
Burnt	No	No	No	No
Algae in hollows %	Absent	Absent	Absent	Absent
Algae in pools %	Absent	Absent	Absent	Absent
Bare peat %	Absent	Absent	Absent	1-3 (many indiv)
High hummocks %	Absent	Absent	Absent	Absent
Low hummocks %	11-25	11-25	11-25	26-33
Hollows %	26-33	1-3 (many indiv)	na	1-3 (many indiv)
Lawns %	11-25	34-50	11-25	26-33
Pools %	11-25	26-33	34-50	34-50
Pool type	Interconnecting	Interconnecting	Interconnecting	Interconnecting
S.austinii hum type	na	Absent	Absent	Absent
S.austinii hum %	4-10	Absent	Absent	Absent
S.austinii height(cm)	na	Absent	na	Absent
S.fuscum hum type	Absent	Absent	Absent	Absent
S.fuscum hum %	Absent	Absent	Absent	Absent
S.fuscum height(cm)	Absent	Absent	Absent	Absent
Leucobryum glaucum	Absent	Absent	Absent	Absent
Trichophorum type	Absent	Absent	na	Flats
Trichophorum %	Absent	Absent	na	1-3 (many indiv)
S.magellanicum %	11-20	1-3 (many indiv)	11-20	26-33
S.cuspidatum %	4-10	26-33	51-75	34-50
S.papillosum %	11-25	26-33	4-10	11-25
S.denticulatum %	na	1-3 (many indiv)	na	Absent

S.capillifolium %	4-10	1-3 (many indiv)	Absent	4-10
S.tenellum %	na	Absent	na	1-3 (many indiv)
S.subnitens var. subnitens %	4-10	Absent	na	Absent
R.fusca %	Absent	Absent	Absent	Absent
R.alba %	4-10	1-3 (several indiv)	11-25	4-10
N.ossifragum %	4-10	1-3 (several indiv)	na	1-3 (many indiv)
Sphag pools %	11-25	26-33	34-50	34-50
Dominant pool Sphag			S.cuspidatum	S.cuspidatum
Sphag lawns %	34-50	26-33	11-25	26-33
Sphag humm %	11-25	11-25	11-25	26-33
Sphag holl %	26-33	1-3 (many indiv)	na	1-3 (many indiv)
Total Sphag %	76-90	76-90	76-90	76-90
Hummocks indicators	S.austinii	Absent	Absent	Absent
Cladonia portent %	Absent	Absent	4-10	Absent
Other Cladonia sp	Absent	Absent	Absent	Absent
C. panicea %	Absent	Absent	Absent	Absent
Calluna cover %	4-10	1-3 (many indiv)	4-10	4-10
Calluna height(cm)	11-20	11-20	41-50	11-20
Other NotableSpecies		S. pulchrum		M. trifoliata, Aulacomnium palustre, Drosera anglica, S. recurvum
Other comment	drier	S .recurvum dominates pools; high E. vaginatum cover (26-33%)		Adjacent to SC
Date	**17/08/2004**	**13/09/2011**	**17/08/2004**	**13/09/2011**

Ecotope type	**Sub-central**	**Sub-central**	**Sub-central**	**Sub-central**
Complex Name	**10/7/4**	**10/9**	**10**	**10/4**
Quadrat Name	Qsc1	Qsc1	Qsc2	Qsc2
Easting	200947	200947	200855	200855.
Northing	203282	203281	203528	203527

Firmness	Very soft	Very soft	Soft	Very soft
Burnt	No	No	No	No
Algae in hollows %	4-10	Absent	Absent	Absent
Algae in pools %	Absent	Absent	Absent	Absent
Bare peat %	4-10	Absent	Absent	1-3 (many indiv)
High hummocks %	na	Absent	na	11-25
Low hummocks %	21-40	76-90	21-40	26-33
Hollows %	11-25	11-25	4-10	4-10
Lawns %	Absent	Absent	Absent	Absent
Pools %	Absent	Absent	11-25	11-25
Pool type	Absent	Absent	Regular	Regular
S.austinii hum type	na	Absent	Absent	Absent
S.austinii hum %	4-10	Absent	Absent	Absent
S.austinii height(cm)	na	Absent	na	Absent
S.fuscum hum type	Absent	Absent	Absent	Absent
S.fuscum hum %	Absent	Absent	Absent	Absent
S.fuscum height(cm)	Absent	Absent	Absent	Absent
Leucobryum glaucum	Absent	Absent	Absent	Absent
Trichophorum type	Absent	Flats	na	Absent
Trichophorum %	Absent	1-3 (several indiv)	na	Absent
S.magellanicum %	21-40	51-75	11-25	4-10
S.cuspidatum %	Absent	Absent	11-25	11-25
S.papillosum %	Absent	Absent	4-10	4-10
S.denticulatum %	Absent	Absent	na	1-3 (many indiv)
S.capillifolium %	26-33	11-25	4-10	4-10
S.tenellum %	Absent	Absent	na	4-10
S.subnitens var. subnitens %	Absent	Absent	na	Absent
R.fusca %	Absent	Absent	Absent	Absent
R.alba %	4-10	1-3 (many indiv)	4-10	11-25
N.ossifragum %	4-10	Absent	1-3 (many indiv)	1-3 (many indiv)
Sphag pools %	Absent	Absent	11-25	11-25
Dominant pool Sphag			S.cuspidatum	S.cuspidatum

Sphag lawns %	11-25	Absent	4-10	Absent
Sphag humm %	21-40	76-90	21-40	34-50
Sphag holl %	11-25	Absent	4-10	4-10
Total Sphag %	51-75	76-90	51-75	51-75
Hummocks indicators	S.austinii	Absent	Absent	Absent
Cladonia portent %	4-10	Absent	4-10	Absent
Other Cladonia sp	Absent		Absent	Absent
C. panicea %	Absent	Absent	Absent	Absent
Calluna cover %	21-40	26-33	11-20	11-25
Calluna height(cm)	21-40	11-20	21-40	31-40
Other NotableSpecies				
Other comment	drier	Adjacent to C (10/15) and SC (10/4)		
Date	**17/08/2004**	**13/09/2011**	**17/08/2004**	**13/09/2011**

Appendix IV Survey maps

Raised Bog Monitoring Survey 2011

Map 1: Ecotopes Map and Quadrats

Ecologic Environmental & Ecological Consultants Ltd.

Ballyduff Bog SAC (000641)
Co. Tipperary

1:5,500

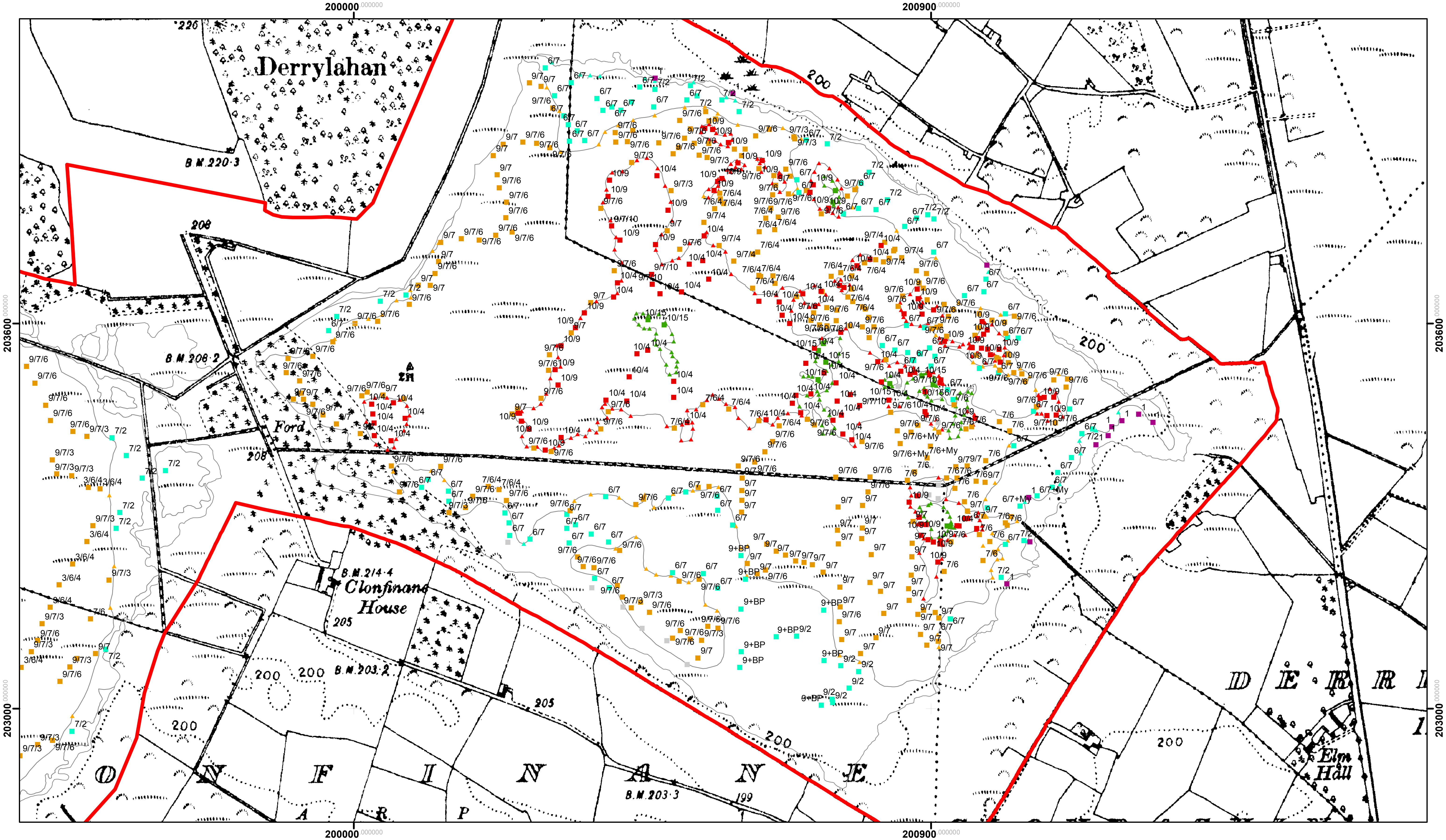
N

0 65 130 260 390 520 Meters

Legend

Ecotope type

- Central
- Sub-central
- Bog Woodland
- Woodland
- Active Flush
- Open water
- Sub-marginal
- Inactive Flush
- Marginal
- Face bank
- Quadrat
- SAC



Raised Bog Monitoring Survey 2011

Map 2: Vegetation community complexes

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Ecologic Environmental & Ecological Consultants Ltd.

Ballyduff Bog SAC (000641)
Co. Tipperary

N

1:5,500

0 70 140 280 420 560 Meters

Legend

Ecotope type
- Central ecotope complex
- Sub-central ecotope complex
- Sub-marginal ecotope complex
- Marginal ecotope complex
- Face bank ecotope complex
- Flush

Boundary type
- SC/C
- F/C
- SM/C
- M/C
- F/SC
- SM/SC
- M/SC
- FB/SC
- F/SM
- M/SM
- SM/FB
- F/M
- M/FB
- F/FB
- Other
- SAC

Raised Bog Monitoring Survey 2011

Map 3: Impacts (High Bog drainage; Turf cutting)

Ecologic Environmental & Ecological Consultants Ltd.

Ballyduff Bog SAC (000641)
Co. Tipperary

1:5,500

0 70 140 280 420 560 Meters

N

Legend

- High bog cut away 2005-2011
- **High Bog drainage**
- Blocked:non-functional
- Blocked:reduced functional
- Not blocked:functional
- Not blocked:non-functional
- Not blocked:reduced functional
- Ecotopes
- SAC