Redwood Bog (SAC 002353), Co. Tipperary

Executive Summary

This survey, carried out in September 2012, aimed to assess the conservation status of habitats listed on Annex I of the European Habitats Directive (92/43EEC) on the high bog at Redwood 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 12.11ha (3.23%) of the high bog area. Central ecotope and active flush are absent from the site, although there is good quality sub-central ecotope present with the *Sphagnum* cover ranging mostly from 51 to 90%. Pools are present (ca. 25% cover in the best quality areas) although the *Sphagnum* cover (mainly *S. cuspidatum*) is rarely complete within these pools.

Degraded Raised Bog covers 362.62ha (96.77%) of the high bog area. It is drier than Active Raised Bog and supports a lower density of *Sphagnum* mosses, although *Sphagnum* cover is as high as 33% in places. It has a less developed micro-topography while permanent pools and *Sphagnum* lawns are generally absent. However, permanent pools are present in the better quality areas, but these pools generally have a low Sphagnum cover. The habitat also includes some inactive flushes.

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

No restoration works have taken place at the site.

The current conservation objective for Redwood 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 92.49ha. 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 to 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 no change in the area of Active Raised Bog (12.11ha) at Redwood in the 2004 to 2012 period. However, the mapped distribution of the habitat has changed somewhat, although all such changes are attributed to the more comprehensive mapping exercise employed in the current survey or in some cases to vegetation re-interpretation. Eight small new sub-central areas (**Sc4**, **Sc5**, **Sc6**, **S7**, **Sc8**, **Sc9**, **Sc10** and **Sc11**) have been described at the site. These are all very small areas and are considered to be the result of a more comprehensive survey in 2012 rather than actual changes in Active Raised Bog. The boundaries of **Sc1**, **Sc2** and **Sc3** have also changed slightly with all areas being mapped as larger in 2012. However, this is again considered to be due to mapping improvements (and vegetation re-interpretation) rather than actual changes although there is the possibility that these three areas are expanding **a**s a result of the high bog recovering from the fire of 2003. This is particularly true in the case of **Sc3**, which is significantly larger than what was mapped in 2004. However, due to a lack of data from this area in 2004, this cannot be conclusively reported.

Peat cutting and drainage are the most threatening current activities at the site. 5.5ha of high bog have been lost in the 2004/05-210 period due to peat cutting. Almost 36km of drains remain functional and 6km reduced functional. An extensive network of drains is also found on the cutover in the areas where lateral peat cutting occurred in the east of lobe 3 and the west of lobe 1. In addition, a severe fire event damaged 33.74ha (9.0%) the high bog in 2012.

Active Raised Bog has been given an overall **Unfavourable Bad–Declining** conservation status assessment. Habitat Area and quality (S&Fs) have remained unchanged in the reporting period. However, both Area and S&Fs values are below favourable reference values. Future Prospects are considered Unfavourable Bad-Declining as impacting activities (peat cutting and drainage) continue to threaten the habitat.

Degraded Raised Bog has been given an overall **Unfavourable Bad-Declining** conservation assessment and **Rhynchosporion depressions** has been given an **Unfavourable Bad-Declining** conservation status assessment.

The **overall raised bog** at **Redwood SAC** has been given an **Unfavourable Bad-Declining** assessment.

A series of **recommendations** have been also given, these include: cessation of peat cutting; restoration works on the high bog and the cutover including the blocking of functional and reduced functional drains; further hydrological and topographical studies to ascertain more accurate FRVs; and further botanical monitoring surveys.

Site identification

SAC Site Code	002353	**6" Sheet:**	TY 71
Grid Reference:	E 194900 / N 211450	**1:50,000 Sheet:**	53
High Bog area (ha):	374.73ha		
Dates of Visit:	18 to 20/09/12 [1]		
Townlands:	Redwood.		

[1] The current extent of the high bog is 374.73ha, while that reported in 2004 was 427.05ha (Fernandez *et al*., 2005). This discrepancy is partially the result of more accurate mapping of the high bog edge by using the higher resolution 2010 aerial images compared to those used in 2004. High bog area has also decreased by 5.51ha in the 2004/05-2010 period due to peat cutting. The actual high bog extent in 2004 was 380.24ha (see tables 8.1 and 8.3 2004 (amended) figures).

Site location

Redwood Bog occurs in northern Tipperary and is located adjacent to the River Shannon (River Shannon Callows, SAC 000216) and River Brosna (River Little Brosna Callows; NHA 000564). Floodplains (callows) of both the Little Brosna and the Shannon rivers adjoin cutover bog within the site all along its northern edge. Ballymacegan Bog (NHA 000642) is 1km to the west, Meneen Bog (NHA 000310) 3km to the west and All Saints Bog and Esker (SAC 000566) lies 5km to the east of the site

Redwood Bog is situated north of the road R489 approximately 16 km north-north-west of Birr. Entry is from R489 heading west from Birr to Portumna, turning right at Ballinacor cross roads where there is a signpost for Redwood Castle. This road should be followed until it forks to the left, at which point the right hand turn should be taken followed by the next left. This accesses the bog along the road through the middle of the site.

Description of the survey

The survey was carried out in September 2012 and involved a vegetation survey of the high bog at Redwood 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 and

Schouten (2002). 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 *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 Redwood 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 for Active Raised Bog.

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

This bog is classified as a Midlands type Raised Bog (Cross 1990) as a medium sized Ridge River C Bog type (Kelly *et al*., 1995). The largest intact portion of Redwood Bog high bog has a complex heart shape with the broadest section to the north and narrowing towards the south. This heart-shaped section itself appears to consist of two basins, which are separated, to some extent, by a stream (or flush) running south to north), which is partially underground. In 1994, only this main lobe (lobe 1) of high bog was surveyed while in 2004 two additional lobes were also surveyed, one to the east (lobe 2) that is separated from the main lobe by a drain and one to the west (lobe 3) that is separated from the main lobe by an access road. In 2012 a final additional lobe (lobe 4) to the south-east, which had been intensively drained at some point in the past was also surveyed. There

has been substantial cutting along the west of lobe 1 and the north of lobe 3 (see Fernandez *et al*. 2005).

Ecological Information

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

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

- Active Raised Bog (EU code 7110),
- Degraded Raised Bog (EU code 7120),
- Depressions on peat substrates of the Rhynchosporion (EU code 7150).

Active Raised Bog (7110)

The current area of Active Raised Bog at Redwood Bog is 12.11ha (3.23% of the high bog), which is a decrease of 30.20ha since 1994.

Active Raised Bog is comprised solely of sub-central ecotope on Redwood Bog.

Sub-central ecotope was found at eleven locations (**Sc1** to **Sc11**) (see Appendix IV, Map 1) and six community complex types were recorded. Complex 9/7 + P and complex 4 + P were the most common dominating **Sc1**, **Sc2**, **Sc3**, **Sc8**, **Sc9** and **Sc10**. Pools averaged at 11-25% cover and the *Sphagnum* cover ranged from 51-90%, being higher in complex 9/7 + P. The micro-topography consisted of high and low hummocks, hollows, lawns and pools. *Eriophorum vaginatum* and *Calluna vulgaris* dominated the vascular plants in complex 9/7 + P while *Rhynchospora alba* and *Calluna vulgaris* dominated in complex 4 + P. *Drosera anglica* and *Menyanthes trifoliata* were found in pools in both complexes as were hummocks of *Leucobryum glaucum*. The *Sphagnum* layer was dominated by *S. cuspidatum* in pools, *S. magellanicum* in lawns and *S. capillifolium* in hummocks. Hummocks of *S. austinii* and *S. fuscum* were also present with active hummocks of *S. austinii* becoming quite frequent in places. The cover of *Cladonia portentosa* was generally quite low indicating past fire disturbances. Complex 9/10 dominated **Sc4** and **Sc11** with a *Sphagnum* cover of 51-75%. There were little or no pools within this complex and *Eriophorum vaginatum*, *Erica tetralix* and *Calluna vulgaris* dominated the vascular plants while *Sphagnum capillifolium*, *S. papillosum* and *S. cuspidatum* dominated the *Sphagnum* layer. A burnt version of this complex (complex 9/10 B) dominated **Sc6**, which was burnt recently. Complex 9/7/10 was found in only one small area (**Sc7**) and was similar to complex 9/10 though with a higher cover of *Calluna vulgaris* and a lower cover of *Sphagnum*

cuspidatum. Complex 4/10 was found in an area (**Sc5**) that appeared to correspond to an area of very old cutover as it occurred adjacent to an old access track. The area was dominated by lawns and pools with very few hummocks. *Rhynchospora alba* dominated the vascular plants while *Sphagnum cuspidatum* and *S. magellanicum* dominated the *Sphagnum* layer.

Degraded Raised Bog (7120)

The current area of Degraded Raised Bog at Redwood Bog is 362.62ha (96.77% of the high bog).

Degraded Raised Bog includes the sub-marginal, marginal and face bank ecotope, as well as inactive flushes. 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. Although pools were mostly absent from the high bog, they were found within the wettest sub-marginal ecotope community complex (9/7/6 + P). However, these pools generally featured a low *Sphagnum* cover and were often covered with algae. The micro-topography generally consisted of hummocks, hollows and in places *Narthecium ossifragum* flats. Five community complex types were recorded within sub-marginal ecotope and the overall *Sphagnum* cover within these ranged from 11 to 25% (though was up to 33% in places). *Calluna vulgaris*, *Eriophorum vaginatum, Rhynchospora alba*, *Narthecium ossifragum* and *Carex panicea* were the most common vascular plants within this ecotope. The *Sphagnum* hummocks consisted mostly of *S. capillifolium* and *S. papillosum* with *S. magellanicum*, *S. austinii* and *S. fuscum* also found though at low cover values. The hollows contained *Eriophorum angustifolium*, open water and occasionally *Sphagnum cuspidatum*. *Narthecium ossifragum* colonised the hollows in drier sections of the habitat and was particularly abundant in the area that was burned recently (complex 6/9 B).

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 consisted of *Calluna vulgaris* hummocks, low *Sphagnum* hummocks, flats and very occasionally hollows and tear pools. The *Sphagnum* cover was even lower here than in the sub-marginal ecotope (<10%) and the vegetation was characterised by a higher cover of *Carex panicea, Narthecium ossifragum, Trichophorum germanicum,* and *Calluna vulgaris*. *Rhynchospora alba* was also frequent where there were run-off channels such as in complex 4/6/2. The alien and disturbance indicator species *Campylopus introflexus* was found in places. Bare peat dominated large tracts of the marginal ecotope where recent peat cutting had occurred due to the methods of peat exploitation (lateral cutting) used. This type of cutting has also resulted in there

being relatively large areas dominated by face-bank ecotope. Face bank ecotope is characterised by firm ground, tall *Calluna vulgaris* and an extremely poor *Sphagnum* cover.

The high bog also featured three relatively large inactive flushes (flush **X**, **Y** and **Z**). Flush Y was located running north-south along the main lobe of high bog and followed the path of a mostly subterranean stream which flows to the north and into the Little Brosna River. Much of this flush was dominated by *Molinia caerulea* as well as *Myrica gale* and *Ulex europaeus* and had a low *Sphagnum* cover. Flush **X** and **Z** also had low *Sphagnum* covers and were also dominated by *Molinia caerulea* with *Cladium* sp. also recorded indicating that these areas maybe fen or associated with a ridge of underlying mineral material.

Depressions on peat substrates of the Rhynchosporion (7150)

Rhynchosporion vegetation is widespread on Redwood 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. It was most frequent in the sub-central complexes 4/10, 9/10 and 4 + P and the sub-marginal complexes 4/7 and 4/9.

In these areas, the Rhynchosporion vegetation occurs within *Sphagnum* hollows and along *Sphagnum* pool edges and on lawns. Typical plant species include *Rhynchospora alba*, *Sphagnum cuspidatum*, *S. papillosum*, *Drosera anglica* and *Eriophorum angustifolium*.

R. alba was also found within degraded raised bog, but always associated with wet features such as hollows and run off channels, being frequent in the marginal complex 4/6/2.

Detailed vegetation description of the high bog

A detailed description of high bog vegetation recorded during the 2012 survey of Redwood 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 Redwood 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)	Location	Habitat affected
C01.03	Peat extraction	H	-1	5.5ha of the high bog cut away	Inside High Bog: 42 different locations along the east of lobe 4 (1 location (plot)), west of lobe 1 (17 locations), east within lobe 2 (3 locations) and around lobe 3 (21 locations) of high bog	**7120**
C01.03	Peat extraction	L	-1	5.5ha of the high bog cut away	""	**7110/7150**
J02.07	Drainage	M	-1	41.93km [1]	Inside High Bog	**7110/7120/7150**
J02.07	Drainage	M	-1	n/av	Outside High Bog	**7110/7120/7150**
J01	Fire	M	-1	33.74ha	Inside High Bog	**7110/7120/7150**
I01	Invasive alien species	L	-1	<0.1ha [3]	Inside High Bog	**7110/7120/7150**

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.

[2] This figure includes blocked drains on 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

This activity has taken place at 42 locations along the east of lobe 4 (1 location (plot)), west of lobe 1 (17 locations), east within lobe 2 (3 locations) and around lobe 3 (21 locations) in the 2004/05-2010 period. This has reduced the area of high bog by 5.51ha. The loss of high bog from peat cutting is calculated using GIS techniques on aerial photography from 2004/05 and 2010. Information from the NPWS indicates that 21 plots were cut on the high bog at Redwood Bog in 2010/2011 and none were cut in 2012. However the activity was reinitiated in 2013 and 4 plots were cut away. Thus the area of high bog lost on Redwood Bog during the reporting period is in excess of 5.51ha, but since there is no aerial photography available post 2010, the area lost from 2010 to 2012 cannot be estimated.

The impact of peat cutting on ARB (7110) and Depressions on peat substrates of the Rhynchosporion (7150) is thought to be low as there has been no loss of habitat during the reporting period. However, the continuation of these activities will prevent the recovery of the high bog, and the recovery of ARB towards FRV's. Restoration works cannot be employed until such activities stop. It should also be borne in mind that peat cutting has already had a serious negative impact over a long period at this site, indicated by the fact that ARB covers only a very small area (12.11ha or 3.23% of the high bog) and is 86.91% below the FRV target.

Habitat losses associated with peat cutting in the current reporting period have been confined mostly to the marginal ecotope (4.12ha), but have also occurred within face-bank ecotope (1.0ha) and inactive flush (0.39ha). Thus, the activity is assessed as having a negative impact of high importance on Degraded Raised Bog.

In addition to the impact of turf cutting in the current reporting period, old face banks and high bog and cutover drainage associated with cutting also continue to cause negative impacts on the high bog habitats. This is especially the case with Redwood Bog due to the type of cutting that has occurred here (lateral cutting). Lateral cutting is particularly damaging to the high bog as it is carried out using machinery working from the high bog surface with the high bog itself subsequently used as a spreading grounds. It also involves cutting a long face-bank laterally into the high bog resulting in a series of long deep drains being cut into the bog itself. Furthermore, as a result of the machinery traffic, the high bog is highly disturbed, compacted and devoid of vegetation, which increases rates of run-off. Thus, this peat cutting technique causes more rapid and extensive damage to the high bog than typical hopper-type face-bank cutting (Fernandez *et al.*, 2005).

Drainage

High bog drainage

Table 6.2 shows that there has been a decrease of 0.60km in the length of functional drains during the reporting period. However, this decrease is the result of the drains being cut into by peat cutting and is thus not a positive development. The majority of drains on the high bog remain functional (35.933km) or reduced functional (5.997km). Reduced functional drains are still impacting on high bog habitats and will continue to do so until they are blocked and become completely in-filled and thus non-functional. The amount of high bog drains on Redwood Bog is particularly high because of the type of peat cutting that has occurred here, lateral cutting. This type of cutting has occurred

along the west of lobe 1 and the north and east of lobe 3. Lobe 4 was also intensively drained in the past and although these drains are now infilling, they are still classed as functional.

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

No blockage of drains has occurred to date.

Table 6.2 High bog drainage summary

Status	2004 (km) [1]	2012 (km)	Change
NB: functional	36.533	35.933	(-)0.600
NB: reduced functional	5.997	5.997	0.000
NB: non- functional	2.381	2.381	0.000
B: functional	0.000	0.000	0.000
B: reduced functional	0.000	0.000	0.000
B: non- functional	0.000	0.000	0.000

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

[1] High bog drainage 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 detail description of the drainage present on the high bog at Redwood Bog including any change in their functionality in the 2004 – 2012 reporting period (see Map 3).

Table 6.3 High bog drainage detail

Drain Name	Length (km)	2004 status	2012 status	Change	Comment
b1-12	3.611	NB: functional	NB: functional	No	
b13a;b; c	1.545	NB: functional	NB: functional	No	
b13d	0.528	NB: non-functional	NB: non- functional	No	
b14	0.819	NB: non-functional	NB: non- functional	No	
bB	0.575	NB: functional	NB: functional	No	Some sections reduced functional
bC	0.777	NB: functional	NB: functional	No	Drain complex
bD1	0.172	NB: non-functional	NB: non- functional	No	Double drain
bE	0.160	NB: non-functional	NB: non- functional	No	
bF1;2	0.218	NB: functional	NB: functional	No	
bF3	0.211	NB: non-functional	NB: non- functional	No	
bG	0.093	NB: functional	NB: functional	No	
bH1-15	4.365	NB: functional	NB: functional	No	

bJ1;2	0.159	NB: functional	NB: functional	No	
bK1;25	10.266	NB: functional	NB: functional	No	Some drains already present in 2004 but not mapped
bK26;39	5.997	NB: reduced functional	NB: reduced functional	No	Drain already present in 2004 but not mapped
bL	13.120	NB: functional	NB: functional	No	Drain complex (76 drains). These drains are not maintained and are thus infilling, mainly with *Sphagnum cuspidatum*. Some of the drains within this complex would be better classed as reduced functional, but a more extensive drain survey would be needed to determine this.
bM	0.953	NB: functional	NB: functional	No	Drain already present in 2004 but not mapped
bN	0.251	NB: functional	NB: functional	No	Drain already present in 2004 but not mapped
D15	0.491	NB: non-functional	NB: non- functional	No	

Bog margin drainage

The cutover areas were not surveyed for drains during 2012.

Kelly *et al.* (1995) noted that the drains bordering lobe one on both the western and eastern sides were relatively deep and intercepted the water-table of a shallow aquifer. Drains associated with either currently active or no longer active peat cutting are particularly abundant to the west of lobe 1 and to the north and east of lobe 3 in the areas where lateral cutting predominated. These drains continue to drain the high bog and impacting on high bog habitats.

Drainage maintenance is evident within agricultural land on the 2010 aerial photograph to the south of drain bM.

Bog margin drainage is considered to have a medium importance/impact on high bog habitats.

Fire history

Kelly *et al.* (1995) noted evidence of regular burning even on the wettest sections of the high bog at Redwood Bog and Fernandez *et al*. (2005) estimated that 90% of lobe 1 has been burnt in 2003.

33.74ha (9.0%) of the high bog (all in lobe 3) was recorded as being recently burnt during the 2012 survey.

Burning is considered to have a medium importance/impact on high bog habitats.

Invasive species

Campylopus introflexus has been recorded across much of the high bog during all three surveys of Redwood Bog (Kelly *et al.*, 1995; Fernandez *et al.*, 2005 and the 2012 survey). No other invasive species have been recorded at Redwood Bog and only a very small number of *Pinus sylvestris* trees have been recorded from the high bog.

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

Afforestation and forestry management

No conifer plantations are present on or adjacent to the high bog.

Other impacting activities

No other significant impacting activities were noted or recorded in 2012 impacting high bog habitats in the 2004-2012 reporting period.

Conservation activities

Although no physical management actions such as the blocking of drains have been carried out to improve the conservation status of the high bog habitats, the NPWS has engaged in negotiation with landowners in relation to the cessation of peat cutting at the site. This is likely to be the main reason why there has been a decrease in the amount of peat cutting at Redwood Bog: 42 plots were cut during the period from 2004-2010, while 21 plots were cut in 2010/2011 and no plots were cut in 2012.

Conservation status assessment

The assessment of the conservation status of Annex I Active and Degraded Raised Bog and Bog Woodland 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

Although table 8.1 indicates no change in the area of Active Raised Bog, there have been some changes to the distribution of habitat and a number of new Active Raised Bog areas have been identified and mapped.

Eight new, small sub-central areas (**Sc4** to **Sc11**) have been mapped. However, none of these are thought to represent a real change to the high bog, as there was a previous lack of mapping points in the areas where they were located (as the maps by Fernandez *et al*., 2005 clearly indicate). Furthermore, there have also been changes in the boundaries of **Sc1**, **Sc2** and **Sc3**, with all three areas now mapped as being slightly larger. However, this is again considered to be due to mapping improvements (and vegetation re-interpretation) rather than actual changes although there is the possibility that these three areas are expanding as a result of the high bog recovering from the fire of 2003. This is particularly true in the case of **Sc3**, which is significantly larger than what was mapped in 2004. However, due to a lack of data in this area in 2004, this cannot be conclusively reported. In regard to the newly mapped sub-central areas, **Sc4** and **Sc5** are located in lobe 4, which was not surveyed in 2004. This lobe has been intensively drained in the past with parallel drains running across the entire lobe. However, these drains are now infilling and thus the two areas of sub-central have developed, but it is not known if they were already present in 2004. **Sc6**, **Sc7**, **Sc8** and **Sc9** are all very small areas of sub-central that have been newly mapped in lobe 3. This lobe was poorly surveyed in 2004 and it is thus likely that these areas were 'missed' at that time due to

their small size. **Sc10** and **Sc11** are located in the north-west of lobe 1 and again are thought to have been overlooked in 2004 due to their small size. It is possible; however, that these areas are improving as the high bog recovers from the fire of 2003.

The favourable reference value (FRV) for Area is considered to be the sum of Active Raised Bog (central and sub-central ecotopes) plus sub-marginal ecotope when the Habitats Directive came into force in 1994 (see table 8.4). Therefore, Active Raised Bog Area FRV is 92.49ha (based on 1994/5 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 (12.11ha) is 86.91% below the FRV. A current Area value more than 15% below FRV falls into the **Unfavourable Bad** assessment category.

Although a long term (1994/5-2012) trend indicates a reduction in the area of Active Raised Bog at the site (30.2ha) (see table 8.1). A more recent and short term trend analysis (8 years; 2004-2012) indicates that there has been no change in the area of Active Raised Bog. Therefore, the habitat Area is given a **Stable** trend assessment.

The Area of Active Raised Bog at Redwood Bog is assessed as Unfavourable Bad-Stable (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 6.06ha (half of 12.11ha, the current area of Active Raised Bog (excluding Bog Woodland)). The current value is 0ha which is 100% below the FRV. Therefore S&Fs are given an **Unfavourable-Bad** assessment.

Although a long term (1994/5-2012) trend indicates a reduction in the area of central ecotope at the site (27.39ha) (see table 8.1). A more recent and short term trend analysis (8 years; 2004-2012) indicates that there has been no change in the area of central ecotope. Therefore, the habitat's S&Fs is given a **Stable** trend assessment.

No quadrats were taken in 2004 and thus no comparisons can be made. However, seven quadrats were recorded in 2012 for future comparative purposes (**Qsc1**, **Qsc2**, **Qsc3**, **Qsc4**, **Qsc5**, **Qsc6** and **Qsc7**).

Typical good quality indicators and typical plant species are still found in sub-central ecotope throughout the entire bog.

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

Future Prospects

Habitat Area has remained unchanged and S&Fs are assessed as stable in the current reporting period. However, there are still 41.93km of functional and reduced functional drains on the high bog with more on the cutover. 21 turf plots were cut in 2010/2011 although none were recorded in 2012, the activity was reinitiated in 2013 and 4 plots were cut away. The high bog has been cutaway extensively and the current ARB area represents a particularly small percentage of the total high bog area. Furthermore, most of the cutting that took place during the reporting period at Redwood Bog was carried out by lateral cutting, which as described under the peat cutting section above is considered to be particularly damaging to the high bog. There are also no significant restoration measures at the site which could override the negative influence of impacting activities.

Habitat **Area** is currently 86.91% below FRV (see table 8.4) and a Decreasing trend is foreseen due to the overriding influence of negatively impacting activities. The habitat Area is expected to be more than 15% below FRV in the following two reporting periods (12 years). Thus, habitat's **Area Future Prospects** are assessed as **Unfavourable Bad-Decreasing**. Habitat's **S&Fs** are currently 100% below FRV (see table 8.4) and a Declining trend is also foreseen. Therefore S&Fs are expected to be more than 25% below FRV in the following two reporting periods. **S&Fs Future Prospects** are assessed as **Unfavourable Bad-Declining**. **The overall habitat's Future Prospects are Unfavourable Bad-Declining** (see table 8.5).

There is some potential for the restoration of cutover around the entire site, but particularly between lobes 1 and 3 as this was where the most intensive cutting has occurred in recent years. In addition, the blocking of functional and reduced-functional drains both on the high bog and cutover and the cessation of peat cutting is necessary. There has been one recent significant fire event affecting 9.0% of the high bog (including some areas of ARB – **Sc6**) in 2012, and such events have been regularly recorded since the 1980s. Such events should be curtailed in order to minimise potential damage to high bog habitats.

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

Table 8.1 Changes in Active Raised Bog area

Active Ecotopes	1994/5[1]	2004	2004 (amended)	2012	Change (2004-2012)

	Area (ha)	Area (ha)	Area (ha)	Area (ha)	Area (ha)	%
Central	27.39	0.00	0.00	0.00	0.00	0.00
Sub-central	14.92	6.53	12.11	12.11	0.00	0.00
Total	**42.31**	**6.53**	**12.11**	**12.11**	**0.00**	**0.00**

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

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 2012. The comparison between 2004 (amended) and 2012 illustrates the actual changes in ecotope area in the 2004-2012 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 2012 (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
Sc1	Qsc1;Qsc2;Qsc4	Stable (possibly increasing)	Slight changes in boundary (larger). This change is the result of more comprehensive surveying in 2012 which resulted in more accurate mapping. However, it should be noted that Sc1 is recovering from the fire of 2003/04 and thus there may have been a real increase in its area during the reporting period.	
Sc2	None	Stable (possibly increasing)	Slight changes in boundary (larger). This change is the result of more comprehensive surveying in 2012 which resulted in more accurate mapping. However, it should be noted that Sc2 is recovering from the fire of 2003/04 and thus there may have been a real increase in its area during the reporting period.	
Sc3	Qsc3	Stable (possibly increasing)	Significant changes in boundary (larger). This change is the result of more comprehensive surveying in 2012 which resulted in more accurate mapping. However, it should be noted that Sc3 is recovering from the fire of 2003/04 and thus there may have been a real increase in its area during the reporting period.	
Sc4	Qsc7	Unknown (likely to be increasing)	This area is likely to have developed as a result of rewetting associated with the infilling of drains. However, as this area was not surveyed in 2004, it cannot be determined for certain.	
Sc5	None	Unknown (likely to be increasing)	This area is likely to have developed as a result of rewetting associated with the infilling of drains. However, as this area was not surveyed in 2004, it cannot be determined for certain.	
Sc6	Qsc6	Unknown	This specific area was not surveyed in 2004. This is likely to be the result of more comprehensive	

Area	Quadrats	Trend	Comment	Quadrats analysis
			surveying in 2012 which resulted in more accurate mapping.	
Sc7	None	Unknown	This specific area was not surveyed in 2004. This is likely to be the result of more comprehensive surveying in 2012 which resulted in more accurate mapping.	
Sc8	None	Unknown	This specific area was not surveyed in 2004. This is likely to be the result of more comprehensive surveying in 2012 which resulted in more accurate mapping.	
Sc9	None	Unknown	This specific area was not surveyed in 2004. This is likely to be the result of more comprehensive surveying in 2012 which resulted in more accurate mapping.	
Sc10	None	Unknown	This specific area was not surveyed in 2004. This is likely to be the result of more comprehensive surveying in 2012 which resulted in more accurate mapping.	
Sc11	Qsc5	Unknown	This specific area was not surveyed in 2004. This is likely to be the result of more comprehensive surveying in 2012 which resulted in more accurate mapping.	

Degraded Raised Bog (7120)

Area

The Degraded Raised Bog FRV for Area is 282.24ha at Redwood Bog. This value corresponds with the difference between the current high bog area (374.73ha) and the Active Raised Bog FRV (92.49ha) 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 28.48% bigger than FRV. Any habitat Area value more than 15% above FRV falls into the **Unfavourable Bad** assessment category, and therefore that is the assessment that applies to DRB habitat Area for Redwood Bog (see table 8.4).

Table 8.3 indicates that there has been a decrease (5.51ha) in the area of Degraded Raised Bog. The decrease has occurred as a result of peat cutting and as a result the habitat is given a **Decreasing** trend.

The Area of Degraded Raised Bog at Redwood 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 90.66ha (25% of 362.62ha, the current area of Degraded Raised Bog). The current marginal and face bank ecotopes area value (237.34ha) is 161.81% 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). Table 8.3 shows that there has been no change in the area of marginal or face-bank ecotope, except for those areas lost to the high bog because of peat cutting. 5.51ha of high bog have been lost to peat cutting and actual increases on the marginal or face banks ecotope extent due to drying out processes have not been reported. However, the quality of marginal ecotope has declined due to the methods of peat cutting used (lateral cutting), which has resulted in areas of high bog being stripped of vegetation and thus to relatively large tracts of marginal ecotope being dominated by bare peat. This obviously illustrates the negative influence of peat cutting on the habitats S&Fs. Thus, the DRB's S&Fs at Redwood Bog are given a **Declining** trend.

The mapping of boundary between marginal and sub marginal is difficult and decreases are only recorded where major changes in the vegetation are evident. Therefore, where no changes are shown, more subtle negative effects cannot be ruled out, and therefore negative changes may have been underestimated. The basic assumption is that were peat cutting has taken place subsidence will occur and will continue for some decades and this will dry out the adjacent areas of the bog.

Typical good quality indicators and typical plant species are still found throughout the entire bog on sub-marginal ecotope.

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

Future Prospects

The area of Degraded Raised Bog has decreased (by 5.51ha) as a result of peat cutting. This activity has also damaged the habitat S&Fs particularly in the west of lobe 1 and the east of lobe 3 where lateral cutting predominates. Peat cutting continues at the site. Furthermore, drainage on the high bog (41.93km of functional and reduced functional drains recorded) and cutover continues to damage the habitat and hinder its recovery to FRV's, as well as minimising the chances of

converting marginal and facebank ecotopes to sub-marginal and/or Active Raised Bog. There are currently no remediation works at the site that might contribute to the restoration of good quality habitat.

There has been one recent significant fire event affecting 9.0% of the high bog in 2012, and such events have been regularly recorded since the 1980s. Such events should be curtailed in order to minimise potential damage to high bog habitats.

Habitat **Area** is currently 28.48% above FRV (see table 8.4) and a Decreasing trend is expected in the following two reporting periods (12 years). As a result 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 161.81% above FRV (see table 8.4). A Declining trend is foreseen in the following two reporting periods and thus **S&Fs** are expected to remain more than 25% above FRV. As a result, habitat's **S&Fs Future Prospects** are assessed as **Unfavourable Bad-Declining**.

Therefore the Future Prospects for Degraded Raised Bog are considered Unfavourable Bad-Declining (see table 8.5).

Table 8.3 Changes in Degraded Raised Bog area

Inactive Ecotopes	**1994/5[1]**	**2004**	**2004 (amended)**	**2012**	**Change (2004-2012)**	
	Area (ha)	**Area (ha)**	**Area (ha)**	**Area (ha)**	**Area (ha)**	**%**
Sub-marginal	50.18	43.46	92.21	92.21	0.00	0.00
Marginal [2]	307.30	335.97	207.59	203.47	(-)4.12	(-)1.98
Face bank[2]	0.20	29.78	34.87	33.87	(-)1.00	(-)2.87
Inactive flush	18.36	11.32	33.46	33.07	(-)0.39	(-)1.17
Total[3]	**403.50**	**420.53**	**368.13**	**362.62**	**(-)5.51**	**(-)1.50**

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

[2] Any 2012 marginal and face bank ecotope value given within the report should be taken as a maximum value. Their extent is based on the 2012 habitat survey and 2010 aerial photographs. It cannot be ruled out that further marginal and/or face bank ecotope losses may have taken place at the margin of the high bog in the 2011-2012 period associated with peat cutting.

[3]The differences in the total area of degraded raised bog between surveys is mostly due to the fact that the 1994 and 2004 surveys did not survey all four lobes of the high bog at Redwood, but is also partially due to differences in interpretation of the high bog boundary. The delineation of the high bog boundary is difficult in the west of lobe 1 and the north and east of lobe 3 due to presence of lateral type peat cutting.

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 2012. The comparison between 2004

(amended) and 2012 illustrates the actual changes in ecotope area in the 2004-2012 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 2012.

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

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 has remained unchanged in the reporting period, as has the area of sub-marginal ecotope. As result habitat Area is given a **Stable** 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. Impacting activities such as peat cutting and drainage on the high bog and cutovers are threatening Active and Degraded Raised Bog. Therefore, the habitat's Area Future Prospects are given an **Unfavourable Bad-Decreasing** 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-Stable** 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-Declining** assessment.

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

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

Table 8.4 Habitats favourable reference values

Habitat	Area Assessment			Structure & Functions Assessment		
	FRV Target (ha) [1]	2012 value (ha) [2]	% below target	FRV 2012 Target (ha) [3]	2012 value (ha) [4]	% below target
7110	92.49	12.11	86.91	6.06	0.00	100

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

[2] 2012 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] 2012 central ecotope and active flush area.

	FRV Target (ha) [5]	2012 value (ha) [6]	% above target	FRV 2012 Target (ha) [7]	2012 value (ha) [8]	% above target
7120	282.24	362.62	28.48	90.66	237.34	161.81

[5] Current high bog area minus 7110 area FRV.

[6] 2012 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–Declining.**
- **Degraded Raised Bog is assessed as being Unfavourable Bad–Declining.**
- **Rhynchosporion depressions is assessed as being Unfavourable Bad–Declining.**

Table 8.5 Habitats conservation status assessments

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

Conclusions

Summary of impacting activities

- Peat cutting still continues at the site and has taken place at 42 locations in the 2004/05-2010 reporting period. 5.51ha of high bog have been lost in this period due to peat cutting and much of this cutting was of the lateral cutting type, which is considered to have a more detrimental effect because it is usually associated with intensive drainage and high disturbance on the high bog including vegetation stripping and soil compaction, which leads to increased rates of water run-off. 21 plots were recorded as being actively cut in 2010/2011. On a positive note, no active peat cutting was recorded in 2012, the activity was reinitiated in 2013 and 4 plots were cut away.
- 35.933km of drains on the high bog remain functional and a further 5.997km are classed as reduced functional.
- Cutover drainage (peripheral drainage) associated with either currently active or no longer active peat cutting continue to impact on the high bog habitats. Kelly *et al.* (1995) noted that the drains bordering lobe one on both the western and eastern sides were relatively deep and intercepted the water-table of a shallow aquifer. Cutover drains are abundant to the west of lobe 1 and to the north and east of lobe 3 in the areas where lateral cutting predominated. All of these drains continue to drain the high bog and impacting on high bog habitats.
- A severe fire event damaged 33.74ha (9.0%) of the high bog in 2012.

Changes in active peat forming areas

- There has been no change in the total area of Active Raised Bog at Redwood Bog in the 2004 to 2012 period. However, the mapped distribution of habitats has changed in several ways, although all such changes are attributed to the more comprehensive mapping exercise employed in the current survey or to vegetation re-interpretation.
- Eight new peat forming areas (**Sc4**, **Sc5**, **Sc6**, **Sc7**, **Sc8**, **Sc9**, **Sc10** and **Sc11**) have been described at the site. These are all very small areas of sub-central and are considered to be the result of a more comprehensive survey in 2012 rather than actual changes in Active Raised Bog.

- The boundaries of **Sc1**, **Sc2** and **Sc3** have changed slightly with all areas being mapped as larger in 2012. However, this is again considered to be due to mapping improvements (and vegetation re-interpretation) rather than actual changes although there is the possibility that these three areas are expanding **a**s a result of the high bog recovering from the fire of 2003. This is particularly true in the case of **Sc3**, which is significantly larger than what was mapped in 2004. However, due to a lack of data from this area in 2004, this cannot be conclusively reported.

Other changes

- There has been no change in the area of marginal or face-bank ecotope, except for those areas lost to the high bog because of peat cutting. However, the quality of marginal ecotope has declined due to the methods of peat cutting used (lateral cutting), which has resulted in areas of high bog being stripped of vegetation and thus to relatively large tracts of marginal ecotope being dominated by bare peat.
- There have been numerous revisions of ecotope boundaries of marginal/sub-marginal on the high bog resulting from more comprehensive surveying, and differences in the interpretation of habitats.
- The boundaries of the inactive flushes, **X**, **Y** and **Z** have been slightly modified, also as a result of more comprehensive surveying.

Quadrats analysis

- No quadrats were taken in 2004 and thus no comparisons can be made. However, seven quadrats were recorded in 2012 for future comparative purposes (**Qsc1**, **Qsc2**, **Qsc3**, **Qsc4**, **Qsc5**, **Qsc6** and **Qsc7**).

Restoration works

- No restoration works have been undertaken at the site.
- NPWS has engaged in negotiation with landowners in relation to the cessation of peat cutting at the site. Despite negotiations peat cutting continued at Redwood Bog until 2011. On a positive note no cutting took place in 2012.

Summary of conservation status

- **Active Raised Bog** has been given an **Unfavourable Bad–Declining** conservation status at Redwood Bog. Habitat Area and quality (S&Fs) have remained unchanged in the reporting period. However both of these assessment criteria are currently substantially below the

FRVs. Future Prospects are considered Unfavourable Bad-Declining as impacting activities (peat cutting and drainage) continue to threaten the habitat.

- **Degraded Raised Bog** has been given an **Unfavourable Bad-Declining** conservation status at Redwood Bog. The habitat Area and S&Fs have decreased due to peat cutting and habitat Area is above the FRV. Future Prospects are considered Unfavourable Bad-Declining due to threatening impacting activities.
- **Depressions on peat substrates of the Rhynchosporion** has been given an **Unfavourable Bad-Declining** conservation status at Redwood Bog. Habitat Area and quality (S&Fs) are considered to have remained stable in the reporting period. However, Future Prospects are considered Unfavourable Bad-Declining as a result of threatening impacting activities.

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

Recommendations

- **Cessation of peat cutting.**
- **Restoration works** including the blocking of high bog functional and reduced-functional drains. Drain complex bK is particularly extensive and its blocking, alone, should bring about very positive results. However, ideally not only would all high bog drains be blocked, but cutover drains as well. The blocking of the cutover drains in the area between lobe 1 and 3 could yield particularly positive results as there is good potential for the restoration of the cutover in this area. This may be particularly important as reaching the ARB target on the high bog alone may not be achievable.
- **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** on the high bog in order to assess changes in the conservation status of habitats, and also potentially, monitoring surveys of cutover areas if they become part of future restoration programmes at the site.

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Appendix I Detailed vegetation description of the high bog

Active Raised Bog (7110)

Central Ecotope Complexes

There were no central complexes on Redwood Bog

Sub-Central Ecotope Complexes

COMPLEX 9/7 + P

- **Location**: this complex occurs in parts of the main area of sub-central ecotope (**Sc1**, **Sc3** and **Sc10**) on lobe 1, but also within **Sc8** and **Sc9** in lobe 3
- **Ground**: soft
- **Physical indicators**: absent
- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: 4-10%
- **Macro-topography**: flat
- **Pools**: 11-25% (26-33% in places)
- ***Sphagnum* cover**: 76-90%
- ***Narthecium* cover**: <4% (4-10% in places)
- **Micro- topography**: high and low hummocks/hollows and pools
- **Tussocks**: absent
- **Degradation or regeneration evidence**: recovering from the burn described in the 2005 report
- **Species cover**: *Eriophorum vaginatum* (11-25%; 4-10% in places), *E. angustifolium* (<4%), *Calluna vulgaris* (34-50%), *Erica tetralix* (<4%), *Rhynchospora alba* (<4%), *Narthecium ossifragum* (<4%), *Trichophorum germanicum* (<4%), *Sphagnum capillifolium* (H; 26-33%), *S. papillosum* (H; 11-25%), *S. tenellum* (H; <4%), *S. austinii* (H; 4-10%), *S. fuscum* (H; <4%), *S. magellanicum* (L/P; 4-10%), *S. cuspidatum* (P; 11-25%), *Leucobryum glaucum* (<4%); *Drosera anglica* (<4%); *Menyanthes trifoliata* (<4%).
- **Additional comments:** this complex is also found in two (very small areas of lobe 3. However, here, the pools are less defined and are more like *Sphagnum*-filled depressions.

Quadrat **Qsc3** was recorded within this complex.

COMPLEX 9/10

- **Location**: this community complex characterises **Sc4**, as well as **Sc11**
- **Ground**: soft
- **Physical indicators**: bare peat <4%
- ***Calluna* height**: 10-20cm
- ***Cladonia* cover**: Absent
- **Macro-topography**: flat
- **Pools**: (<4% few)
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: <4%
- **Micro- topography**: Low hummocks/hollows
- **Tussocks**: *Trichophorum germanicum* 4-10%, *Eriophorum vaginatum* 11-25%
- **Degradation or regeneration evidence**: Regeneration after burning pre-2004 survey
- **Species cover**: *Calluna vulgaris* (4-10%), *Erica tetralix* (11-25%), *Eriophorum vaginatum* (11-25%), *Narthecium ossifragum* (<4% several), *Rhynchospora alba* (11-25%), *Trichophorum germanicum (4-10%) Sphagnum capillifolium* (Hummocks 4-10%), *S. austinii* (H; 4-10%), *S. papillosum* (11-25%), *S. cuspidatum* (11-25%). *S. magellanicum* (<4%). *S. tenellum* (<4%).
- **Additional comments**: This description was taken in **Sc11**, a small area on a flat plateau that then slopes down to northern edge of bog. The *Sphagnum* cover is deep and spongy wet with a few *S. fuscum* hummocks nearby. In between the good sub-central habitat are areas of 4/9 sub-marginal habitat.

Quadrat **Qsc5** was recorded within this complex within **Sc11**.

COMPLEX 9/10 (B) BURNT

- **Location**: Southern part of lobe 3 within **Sc6**
- **Ground**: soft
- **Physical indicators**: recently burnt, bare peat 5%
- ***Calluna* height**: 5cm
- ***Cladonia* cover**: Absent
- **Macro-topography**: flat – gentle slope towards south-west edge
- **Pools**: (<4% several)
- ***Sphagnum* cover**: dead hummocks (26-33%), Live *Sphagna* (34-50%)
- ***Narthecium* cover**: (<4% few)
- **Micro- topography**: Relic burnt high hummocks, active Low hummocks/hollows/pools

- **Tussocks**: *Eriophorum vaginatum* (4-10%)
- **Degradation or regeneration evidence**: Degradation due to recent burning
- **Species cover**: *Calluna vulgaris* (4-10%), *Eriophorum vaginatum* (4-10%), *Narthecium ossifragum* (<4% few), *Rhynchospora alba* (<4% few), *Sphagnum cuspidatum* (11-25%), *S. magellanicum* (4-10%), *S. papillosum* (11-25%), *Sphagnum capillifolium* (Hummocks 4-10%), *S. austinii* (< 4%), *S. tenellum* (<4%).
- **Additional comments**: Quite a small area of soft sub-central habitat. The recent burning exposes the extent of *Sphagnum* lawn and low hummock that may have been less visible under the heather canopy, pre-burning. The cover of *Narthecium ossifragum* increases towards the south-west of this complex reaching cover values of 26-33% in places as the complex grades into sub-marginal complex 6/9 (B). The overall *Sphagnum* cover (burnt and living) is 51-75% in these areas.

Quadrat **Qsc6** was recorded within this complex.

COMPLEX 9/7/10

- **Location**: this community complex dominates **Sc7**
- **Ground**: Soft
- **Physical indicators**: Absent
- ***Calluna* height**: 20-30cm
- ***Cladonia* cover**: 4-10%
- **Macro-topography**: Flat
- **Pools**: absent
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: 4-10%
- **Micro- topography**: hummocks/hollows
- **Tussocks**: *Eriophorum vaginatum*
- **Degradation or regeneration evidence**: Absent
- **Species cover**: *Calluna vulgaris* (34-50%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (11-25%), *Rhynchospora alba* (<4%), *Drosera anglica* (<4%), (*Sphagnum cuspidatum* (Hl; 4-10%), *S. magellanicum* (Hl; <4%), *S. papillosum* (H & Hl; 11-25%), *Sphagnum capillifolium* (H; 26-33%).
- **Additional Comments**: None

COMPLEX 4/10

- **Location**: **Sc5** lobe 4, at southern end, parallel to an old peat access track onto the high bog
- **Ground**: Very soft
- **Physical indicators**: Absent
- ***Calluna* height**: 10-20cm
- ***Cladonia* cover**: (<4% few)
- **Macro-topography**: Linear depression
- **Pools**: (26-33%)
- ***Sphagnum* cover**: (90-100%)
- ***Narthecium* cover**: (<4% few)
- **Micro- topography**: Lawns/pools, few low hummocks
- **Tussocks**: Absent
- **Degradation or regeneration evidence**: Absent
- **Species cover**: *Calluna vulgaris* (<4%), *Erica tetralix* (<4%), *Eriophorum angustifolium* (<4%), *Narthecium ossifragum* (<4% few), *Rhynchospora alba* (25-33%), *Myrica gale* (<4%), *Sphagnum cuspidatum* (33-50%), *S. magellanicum* (26-33%), *S. papillosum* (11-25%), *Sphagnum capillifolium* (Hummocks 4-10%).
- **Additional comments**: This sub-central may be in an old cutover area adjacent to access track, but no obvious evidence of turf cutting. The high bog has been extensively drained with narrow drains at 20m intervals. Drains infilling with *Sphagnum cuspidatum*. *Myrica gale* frequent on high bog.

COMPLEX 4 + P

- **Location**: this complex dominates large areas **Sc1**, **Sc2** and **Sc3** (particularly in the south) of the main area of sub-central ecotope on lobe 1
- **Ground**: soft
- **Physical indicators**: bare peat (<4%)
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: flat
- **Pools**: 4-10% (11-25% in places)
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: <4% (4-10% in places)
- **Micro- topography**: low hummocks/hollows and pools

- **Tussocks**: absent
- **Degradation or regeneration evidence**: recovering from the burn described in the 2005 report
- **Species cover**: *Rhynchospora alba* (11-25%), *Calluna vulgaris* (34-50%), *Erica tetralix* (4-10%), *Eriophorum angustifolium* (<4%), *E. vaginatum* (4-10%), *Narthecium ossifragum* (<4%), *Trichophorum germanicum* (<4%), *Sphagnum capillifolium* (H; 26-33%), *S. papillosum* (H/Hl; 4-10%), *S. tenellum* (H; 4-10%), *S. austinii* (H; <4%), *S. magellanicum* (L/P; <4%), *S. cuspidatum* (P; 4-10%), *Leucobryum glaucum* (<4%); *Drosera anglica* (<4%); *Menyanthes trifoliata* (<4%).
- **Additional comments:** in some parts of this complex the cover of active hummocks of *Sphagnum austinii* is 4-10% and the overall *Sphagnum* cover increases to 76-90%.

Quadrats **Qsc1, Qsc2** and **Qsc4** were recorded within this complex.

Active flushes

FLUSH Y

- **Location**: Located in central part of lobe 1, at the western edge of Flush Y, south of the active flush (red dot) recorded in 2004 survey. Active area too small to map so represented by a single dot.
- **Ground**: very soft
- **Physical indicators**: none
- ***Calluna* height**: 20-30cm
- ***Cladonia* cover**: 4-10%
- **Macro-topography**: depression
- **Pools**: 4-10%
- ***Sphagnum* cover**: 51-75%
- ***Narthecium* cover**: <4%
- **Micro- topography**: Low hummocks/hollows/lawns
- **Tussocks**: absent
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (4-10%), *Erica tetralix* (11-25%), *Eriophorum vaginatum* (11-25%), *Myrica gale (<4%) Trichophorum <4%. Sphagnum cuspidatum* Pools and Hollows (Hl); 11-25%), *S. magellanicum* (11-25%), *Sphagnum capillifolium* (H; 11-25%), *S. papillosum* (H; 4-10%), *S. tenellum* (H; <4%).

- **Additional comments:** A notable small depression in the Flush area defined by the green colour of *Eriophorum vaginatum*. The lowest and wettest part of the depression with sub-central vegetation described above.

Degraded Raised Bog (7120)

Sub-Marginal Ecotope Complexes

COMPLEX 9/7/6 + P

- **Location**: this complex occurs in parts of lobe 1 close to and grading into **Sc**3 and also near **Sc10**
- **Ground**: soft
- **Physical indicators**: absent
- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: flat
- **Pools**: 11-25%
- ***Sphagnum* cover**: 26-33% (11-25% in places)
- ***Narthecium* cover**: 26-33% (34-50% in places)
- **Micro- topography**: high and low hummocks/flats/hollows and pools
- **Tussocks**: absent
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Eriophorum vaginatum* (<4%; 4-10% in places), *E. angustifolium* (<4%), *Calluna vulgaris* (34-50%), *Narthecium ossifragum* (26-33%), *Erica tetralix* (<4%), *Rhynchospora alba* (4-10%), *Trichophorum germanicum* (<4%), *Sphagnum capillifolium* (H; 11-25%), *S. papillosum* (H/P; 4-10%), *S. tenellum* (H; <4%), *S. austinii* (H; <4%), *S. magellanicum* (P; <4%), *S. cuspidatum* (P; 4-10%), *Leucobryum glaucum* (<4%); *Drosera anglica* (<4%); *Menyanthes trifoliata* (<4%).
- **Additional comments:** the pools within this complex appear to be suffering from desiccation and have a very patchy cover of *Sphagnum* often with *S. papillosum* dominating over *S. cuspidatum*.

COMPLEX 9/7/6

- **Location**: this complex occurs throughout much of the sub-marginal ecotope on Redwood Bog
- **Ground**: soft
- **Physical indicators**: absent

- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: flat/gentle slope
- **Pools**: absent
- ***Sphagnum* cover**: 11-25 % (26-33% in places)
- ***Narthecium* cover**: 26-33%
- **Micro- topography**: high and low hummocks/flats/hollows
- **Tussocks**: absent
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Eriophorum vaginatum* (4-10%), *E. angustifolium* (<4%), *Calluna vulgaris* (34-50%), *Narthecium ossifragum* (26-33%), *Erica tetralix* (<4%), *Rhynchospora alba* (4-10%), *Carex panicea* (<4%), *Trichophorum germanicum* (<4%), *Sphagnum capillifolium* (H; 11-25%), *S. papillosum* (H/Hl; 4-10%), *S. tenellum* (H; <4%), *S. austinii* (H; <4%), *S. magellanicum* (Hl; <4%), *S. cuspidatum* (Hl; 4-10%), *Leucobryum glaucum* (<4%).
- **Additional comments:** *Carex panicea* (11-25%) increases in cover in some areas at the expense of *Narthecium ossifragum* (4-10%) and here the complex is termed 9/7/3. Complex 9/7/6grades into the marginal complex 7/6 in places where the cover of *Eriophorum vaginatum* decreases and that of *Narthecium ossifragum* increases.

COMPLEX 4/9

- **Location**: this complex is found mostly on northern section of lobe 1
- **Ground**: firm to soft
- **Physical indicators**: bare peat <4%
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: <4% (4-10% in places)
- **Macro-topography**: gentle slope
- **Pools**: <4% (4-10% in places)
- ***Sphagnum* cover**: 11-25% (26-33% in places)
- ***Narthecium* cover**: 4-10%
- **Micro- topography**: Low hummocks/hollows
- **Tussocks**: *Eriophorum vaginatum* (4-10%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Rhynchospora alba* (11-25%), *Eriophorum vaginatum* (4-10%), *E. angustifolium* (<4%), *Calluna vulgaris* (26-33%), *Erica tetralix* (4-10%), *Carex panicea* (<4%; 4-10% in places),

Trichophorum germanicum (<4%), *Narthecium ossifragum* (4-10%), *Myrica gale* (<4%), *Sphagnum capillifolium* (H; 4-10%), *S. papillosum* (H/Hl; 4-10%), *S. tenellum* (H; 4-10%), *S. subnitens* (H; <4%), *S. cuspidatum* (Hl/P; 4-10%).

- **Additional comments:** where this complex grades into sub-central ecotope (complex 4 +P), the cover of *Eriophorum vaginatum* increases along with the cover of *Sphagnum cuspidatum* in the pools; where this complex grades into marginal ecotope, the cover of *Eriophorum vaginatum* decreases and the cover of *Trichophorum germanicum* increases. In such areas a complex **4/9/2** is recorded in places and although this is classed as sub-marginal ecotope, it has some characteristics of marginal ecotope and is essentially a 'borderline' marginal/sub-marginal complex.

COMPLEX 6/9 (B) BURNT

- **Location**: this complex is found at the southern end of lobe 3 in a recently burnt area around Sc6.
- **Ground**: Soft
- **Physical indicators**: Recently burnt, bare peat (10%))
- ***Calluna* height**: <5cm
- ***Cladonia* cover**: Absent
- **Macro-topography**: Flat
- **Pools**: Absent
- ***Sphagnum* cover**: living sphagna (26-33%) burnt hummocks (11-25%)
- ***Narthecium* cover**: (50-75%)
- **Micro- topography**: High hummocks/low hummocks/ hollows/flats
- **Tussocks**: Absent
- **Degradation or regeneration evidence**: Degradation due to recent burning across significant part (>30%) of lobe 3. Higher plants re-sprouting. Lower plants slower.
- **Species cover**: *Calluna vulgaris* (11-25%), *Eriophorum vaginatum* (<4%) *E. angustifolium* (4-10%), *Narthecium ossifragum* (50-75%), *Sphagnum magellanicum* (4-10%), *S. cuspidatum* (4-10%), S. *papillosum* (4-10%), *S. cuspidatum* (<4%), *S. austinii* (<4%), *Leucobryum glaucum* (<4%).
- **Additional comments** Vegetation just beginning to recover after recent burning. Sphagna on hummocks mostly dead.

COMPLEX 4/7

- **Location**: this community complex dominates sub-marginal ecotope within lobe 4

- **Ground**: Firm to soft
- **Physical indicators**: Bare peat (<4%))
- ***Calluna* height**: 20-30cm
- ***Cladonia* cover**: (4-10%)
- **Macro-topography**: Gentle slope towards south edge
- **Pools**: (<4%)
- ***Sphagnum* cover**: (26-33%)
- ***Narthecium* cover**: Absent
- **Micro- topography**: Low hummocks/ hollows
- **Tussocks**: *Trichophorum germanicum* (<4%)
- **Degradation or regeneration evidence**: Difficult to say if worse since 2004 survey. Assume so.
- **Species cover**: *Calluna vulgaris* (11-25%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (<4%) *E. angustifolium* (<4%), *Rhynchospora alba (26-33%), Myrica gale (4-10%), Sphagnum Tenellum (11-25%), S. magellanicum* (<4%), *S. cuspidatum* (<4%), S. *papillosum* (4-10%), *S. cuspidatum* (<4%), *S. subnitens* (<4%).
- **Additional comments** Open water pools often devoid of *Sphagnum* spp. Whole area intensively drained with criss-cross of narrow drains at 20m intervals.

Marginal Ecotope Complexes

COMPLEX 4/6/2

- **Location**: this complex is found along margin of lobe 1
- **Ground**: firm
- **Physical indicators**: bare peat (4-10%); *Campylopus introflexus* (<4%)
- ***Calluna* height**: 11-20cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: gentle to steep slope
- **Pools**: absent
- ***Sphagnum* cover**: 4-10% (11-25% in places)
- ***Narthecium* cover**: 11-25% (26-33% in places)
- **Micro- topography**: low hummocks/*Narthecium ossifragum* flats/*Rhynchospora alba* hollows and run-off channels.
- **Tussocks**: *Trichophorum germanicum* (4-10%)
- **Degradation or regeneration evidence**: absent

- **Species cover**: *Rhynchospora alba* (11-25%), *Narthecium ossifragum* (11-25%), *Trichophorum germanicum* (4-10%), *Calluna vulgaris* (26-33%), *Carex panicea* (4-10%), *Erica tetralix* (4-10%), *Eriophorum vaginatum* (<4%), *E. angustifolium* (<4%), *Myrica gale* (<4%), *Sphagnum capillifolium* (H; 4-10%), *S. tenellum* (H; <4%), *S. subnitens* (H; <4%), *S. papillosum* (H; <4%), *S. cuspidatum* (Hl; <4%).
- **Additional comments**: this complex is very wet in parts with *Rhynchospora alba* dominated run-off channels leading down the slope to flush Y and is considered to be borderline sub-marginal in places.

COMPLEX 6/7

- **Location**: Lobe 3 in an unburnt part at the south-western side as well as lobe 4
- **Ground**: firm
- **Physical indicators**: Bare peat (<4%))
- ***Calluna* height**: (20-30)cm
- ***Cladonia* cover**: (4-10%)
- **Macro-topography**: Flat
- **Pools**: Absent
- ***Sphagnum* cover**: (4-10%)
- ***Narthecium* cover**: (34-50%)
- **Micro- topography**: Low hummocks/ hollows/flats
- **Tussocks**: Absent
- **Degradation or regeneration evidence**: Absent
- **Species cover**: *Calluna vulgaris* (26-33%), *Erica tetralix* (<4%), *Narthecium ossifragum* (34-50%), *Trichophorum germanicum* (<4%), *Eriophorum vaginatum* (<4%) *E. angustifolium* (<4%), *Sphagnum cuspidatum (<4%), S. subnitens* (<4%), S. *papillosum* (<4%), *S. capillifolium* (<4%), *Hypnum jutlandicum* (<4%), *Cladonia uncialis* (<4%).
- **Additional comments** Extensive flats of *Narthecium*, ground quite firm. Where the cover of *Carex panicea* increases to ca. >10%, the complex is termed 6/7/3.

COMPLEX 2/6

- **Location**: this complex is found around northern edges lobe 1 but also south of lobe 3
- **Ground**: firm to soft
- **Physical indicators**: bare peat (<4%, 4-10% in places)
- ***Calluna* height**: 20-30cm

- ***Cladonia* cover**: <4%
- **Macro-topography**: slight slope towards south
- **Pools**: few <4%
- ***Sphagnum* cover**: 4-10%
- ***Narthecium* cover**: 34-50%
- **Micro- topography**: low hummocks/*Narthecium ossifragum* flats/ hollows
- **Tussocks**: *Trichophorum germanicum* (<4%)
- **Degradation or regeneration evidence**: probable regeneration since burning pre-2004 survey.
- **Species cover**: *Calluna vulgaris* (34-50%), *Erica tetralix* (11-25%), *Eriophorum vaginatum* (<4%), *E. angustifolium* (<4%), *Narthecium ossifragum* (34-50%), *Trichophorum germanicum* (4-10%), *Sphagnum capillifolium* (H; <4%), *S. tenellum* (H; <4%), *S. subnitens* (H; <4%), *S. papillosum* (H; <4%).
- **Additional comments**: None.

COMPLEX 7/2

- **Location**: as the east of lobe 1
- **Ground**: firm
- **Physical indicators**: Bare peat (<4%))
- ***Calluna* height**: 21-30cm
- ***Cladonia* cover**: 4-10%
- **Macro-topography**: Gentle to steep slope to high bog margin
- **Pools**: Absent
- ***Sphagnum* cover**: 4-10%
- ***Narthecium* cover**: 4-10%
- **Micro- topography**: Low hummocks/ hollows/flats
- **Tussocks**: *Trichophorum germanicum* (4-10%),
- **Degradation or regeneration evidence**: Absent
- **Species cover**: *Calluna vulgaris* (34-50%), *Erica tetralix* (<4%), *Narthecium ossifragum* (4-10%), *Trichophorum germanicum* (4-10%), *Eriophorum vaginatum* (<4%), *Sphagnum capillifolium* (4-10%), *Hypnum jutlandicum* (<4%).
- **Additional comments** Where *Myrica gale* is present the complex is termed 7/2 + My.

COMPLEX 3/6 (B) BURNT

- **Location**: this complex is found at the southern end of lobe 3 in a recently burnt area.

- **Ground**: firm
- **Physical indicators**: Recently burnt, bare peat (50%))
- ***Calluna* height**: <5cm
- ***Cladonia* cover**: Absent
- **Macro-topography**: slight slope towards eastern margin
- **Pools**: (<4% few)
- ***Sphagnum* cover**: living *Sphagna* (<4%) burnt hummocks (4-10%)
- ***Narthecium* cover**: 26-33%
- **Micro- topography**: low hummocks/ flats
- **Tussocks**: regenerating *Trichophorum germanicum* (<4%)
- **Degradation or regeneration evidence**: Degradation due to recent burning across significant part (>30%) of lobe 3. Higher plants re-sprouting. Lower plants slower.
- **Species cover**: *Calluna vulgaris* (4-10%), *E. angustifolium* (<4%), *Narthecium ossifragum* (26-33%), *Trichophorum germanicum* (4-10%), *Sphagnum tenellum*, (<4%), S. *papillosum* (H; <4%).
- **Additional comments** Vegetation just beginning to recover after recent burning. *Sphagnum* hummocks mostly burnt. Living *Sphagna* mostly in pools or lawn areas.

COMPLEX 3/6/4

- **Location**: Lobe 3 in an unburnt part at the south-eastern side
- **Ground**: firm
- **Physical indicators**: Bare peat (<4%))
- ***Calluna* height**: (26-33)cm
- ***Cladonia* cover**: (4-10%)
- **Macro-topography**: Sloping gently-steeply towards road to the east.
- **Pools**: Absent
- ***Sphagnum* cover**: (<4%), locally (4-10%)
- ***Narthecium* cover**: (4-10%)
- **Micro- topography**: Low hummocks/ hollows/flats
- **Tussocks**: *Trichophorum germanicum* (<4%)
- **Degradation or regeneration evidence**: Extensive network of drains
- **Species cover**: *Calluna vulgaris* (34-50%), *Erica tetralix* (4-10%), *Narthecium ossifragum* (4-10%), *Rhynchospora alba* (4-10%), *Carex panicea* (11-25%). *Sphagnum subnitens* (<4%), S. *papillosum* (<4%), *S. capillifolium* (<4%), *S. tenellum* (<4%), *Pleurozia purpurea* (<4%).

- **Additional comments** Extensive network of narrow drains criss-crossing the bog, often filled with water and *Sphagnum cuspidatum*. Occasional *Pinus sylvestris* or *Betula pubescens* sapling 1-3m high in this area. *Pleurozia purpurea* looking surprisingly healthy and vigorous here.

Inactive flushes

FLUSH X

- This flush was located in the south of lobe 4 was not surveyed in 2012. The 2004 survey described it as an inactive flush with *Molinia caerulea* dominating in a dry *Sphagnum*-poor flush with frequent *Cladium* sp. indicating that the area may be fen-like.

FLUSH Y

- This flush is orientated in an N-S direction and splits the main lobe of high bog in two. It was not surveyed in detail in 2012 but was described in the past by Kelly *et al.* (1995) and Fernandez *et al.* (2005): flush Y follows the path of a mostly subterranean stream which flows to the north and into the Little Brosna River. Significant flow was recorded by Kelly *et al.* as well as during the 2012 survey. Much of the flush is dominated by *Molinia caerulea* as well as *Myrica gale* and *Ulex europaeus* although a small area (ca. 5m x 5-10m) of the flush is classed as active and described under ARB. Several swallow holes have been recorded in which *Salix* sp. are found. The high bog slopes down to this flush from both sides. Other species recorded include *Betula pubescens*, *Vaccinium myrtillus*, *Rubus fruticosus*, *Potentilla erecta* and *Pteridium aquilinum*.

FLUSH Z

- This flush was not surveyed in detail in 2012 but was described in the past by Kelly *et al.* (1995) and Fernandez *et al.* (2005): This is a dry *Sphagnum*-poor flush that is located in the south of the main lobe of high bog. It is quite narrow and extends in a N/S direction with an arc over towards the east in its northern part. In general *Molinia caerulea* dominates along with *Betula pubescens*, *Myrica gale*, *Ulex europaeus*, and *Calluna vulgaris*. A narrow (3 m) linear band of *Phragmites australis* and *Cladium* leads towards the NNW to a solitary 4-5 m *Pinus* sp. tree. Kelly *et al.*, (1995) speculated that the presence of *Cladium* indicates that the area maybe fen or that it may be associated with a ridge of underlying mineral material. The northern part corresponds to an area on the 1910 6" sheet, which indicates an area of *Ulex* scrub. This flush is inactive and connects with flush Y to the north.

Face bank Complexes

COMPLEX 1

- **Location**: this complex is found along the bog margin and sometimes along the edge of drains
- **Ground**: firm
- **Physical indicators**: bare peat (4-10%)
- ***Calluna* height**: >50cm
- ***Cladonia* cover**: <4%
- **Macro-topography**: steep slope
- **Pools**: absent
- ***Sphagnum* cover**: <4%
- ***Narthecium* cover**: <4%
- **Micro- topography:** tall robust *Calluna vulgaris*/low hummocks
- **Tussocks:** *Trichophorum germanicum* (<4%)
- **Degradation or regeneration evidence**: absent
- **Species cover**: *Calluna vulgaris* (76-90%), *Trichophorum germanicum* (<4%), *Narthecium ossifragum* (<4%), *Andromeda polifolia* (<1%), *Sphagnum capillifolium* (H; <1%), *S. tenellum* (H; <1%), *S. subnitens* (H; <1%), *Hypnum jutlandicum* (<4%).
- **Additional comments**: none

Depressions on peat substrates of the Rhynchosporion (7150)

The habitat occurs at Redwood Bog in both Active and Degraded Raised Bog, but it is only occasional found on degraded habitat. Only *Rhynchospora alba* was recorded within the 2012 survey at this site.

R. alba is found in all ecotopes in Redwood Bog, such as: sub-central ecotope (4/10; 9/10; 4 + P; 9/7 + P; 9/10 (B); 9/7/10); sub-marginal ecotope (4/7; 4/9; 9/7/6 +P; 9/7/6), marginal ecotope (4/6/2 and 3/6/4) and face bank ecotope (1).

The species becomes very frequent within complexes 4/10, 9/10 and 4 + P (sub-central); 4/7 and 4/9 (sub-marginal) and 4/6/2 (marginal, but within run off channels).

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 and marginal ecotope complexes.

R. alba was also recorded in more degraded areas of the bog such as steep slope sections at the edge of the bog where bare peat and erosion channels are found.

Appendix II Photographical records

Photograph Number	Aspect	Type	Feature	Date
0324	NE	Overview	Qsc1	18/09/2012
0325	NE	Overview	Qsc2	18/09/2012
0331	N	Overview	Qsc3	18/09/2012
0332	NE	Overview	Qsc4	18/09/2012
0337	NE	Overview	Qsc5	19/09/2012
0342	NE	Overview	Qsc6	20/09/2012
0343	NE	Overview	Qsc7	20/09/2012

Appendix III Quadrats

Ecotope type	**Sub-marginal**	**Sub-central**	**Sub-central**	**Sub-central**
Complex Name	**4 + P**	**4 + P**	**9/7 + P**	**4 + P**
Quadrat Name	Qsc1	Qsc2	Qsc3	Qsc4
Easting	195106.32	195017.59	195292.50	195156.43
Northing	211308.90	211424.60	211748.24	211489.82
Date	18/09/2012	18/09/2012	18/09/2012	18/09/2012
Firmness	Soft	Soft	Soft	Soft
Burnt	No	No	No	No
Algae in hollows %	Absent	Absent	Absent	Absent
Algae in pools %	Absent	Absent	Absent	Absent
Bare peat %	Absent	Absent	Absent	Absent
High hummocks %	Absent	26-33	4-10	Absent
Low hummocks %	51-75	34-50	34-50	51-75
Hollows %	11-25	1-3 (few indiv)	4-10	4-10
Lawns %	Absent	Absent	Absent	Absent
Pools %	4-10	4-10	26-33	11-25
Pool type	Regular	Regular	Interconnecting	Regular
S.austinii hum type	Active	Absent	Absent	Active
S.austinii hum %	1-3 (many indiv)	Absent	Absent	4-10
S.austinii height(cm)	0-10	Absent	Absent	0-10
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	Present	Absent
Trichophorum type	Flats	Flats	Absent	Absent
Trichophorum %	1-3 (few indiv)	1-3 (few indiv)	Absent	Absent
S.magellanicum %	Absent	Absent	Absent	Absent
S.cuspidatum %	11-25	4-10	11-25	4-10
S.papillosum %	4-10	4-10	26-33	4-10
S.denticulatum %	Absent	Absent	Absent	Absent
S.capillifolium%	34-50	34-50	26-33	26-33
S.tenellum %	4-10	11-25	4-10	4-10

Ecotope type	**Sub-marginal**	**Sub-central**	**Sub-central**	**Sub-central**
Complex Name	**4 + P**	**4 + P**	**9/7 + P**	**4 + P**
S.subnitens %	Absent	Absent	Absent	Absent
R.fusca %	Absent	Absent	Absent	Absent
R.alba %	11-25	4-10	4-10	4-10
N.ossifragum %	Absent	Absent	4-10	1-3 (many indiv)
Sphag pools %	4-10	4-10	26-33	11-25
Dominant pool Sphag	S.cuspidatum	S.cuspidatum	S.cuspidatum	S.cuspidatum
Sphag lawns %	Absent	Absent	Absent	Absent
Sphag humm %	51-75	51-75	34-50	34-50
Sphag holl %	4-10	1-3 (many indiv)	Absent	4-10
Total Sphag %	76-90	76-90	76-90	51-75
Hummocks indicators	S.austinii	Absent	Absent	S.austinii
Cladonia portent %	1-3 (several indiv)	4-10	1-3 (few indiv)	1-3 (many indiv)
Other Cladonia sp		C. uncialis		
C. panicea %	1-3 (few indiv)	Absent	1-3 (several indiv)	1-3 (few indiv)
Calluna cover %	34-50	34-50	34-50	51-75
Calluna height(cm)	11-20	31-40	21-30	21-30
Other NotableSpecies			Menyanthes. Drosera anglica	Menyanthes. Drosera anglica
Other comment			S. austinii adjacent to quad	

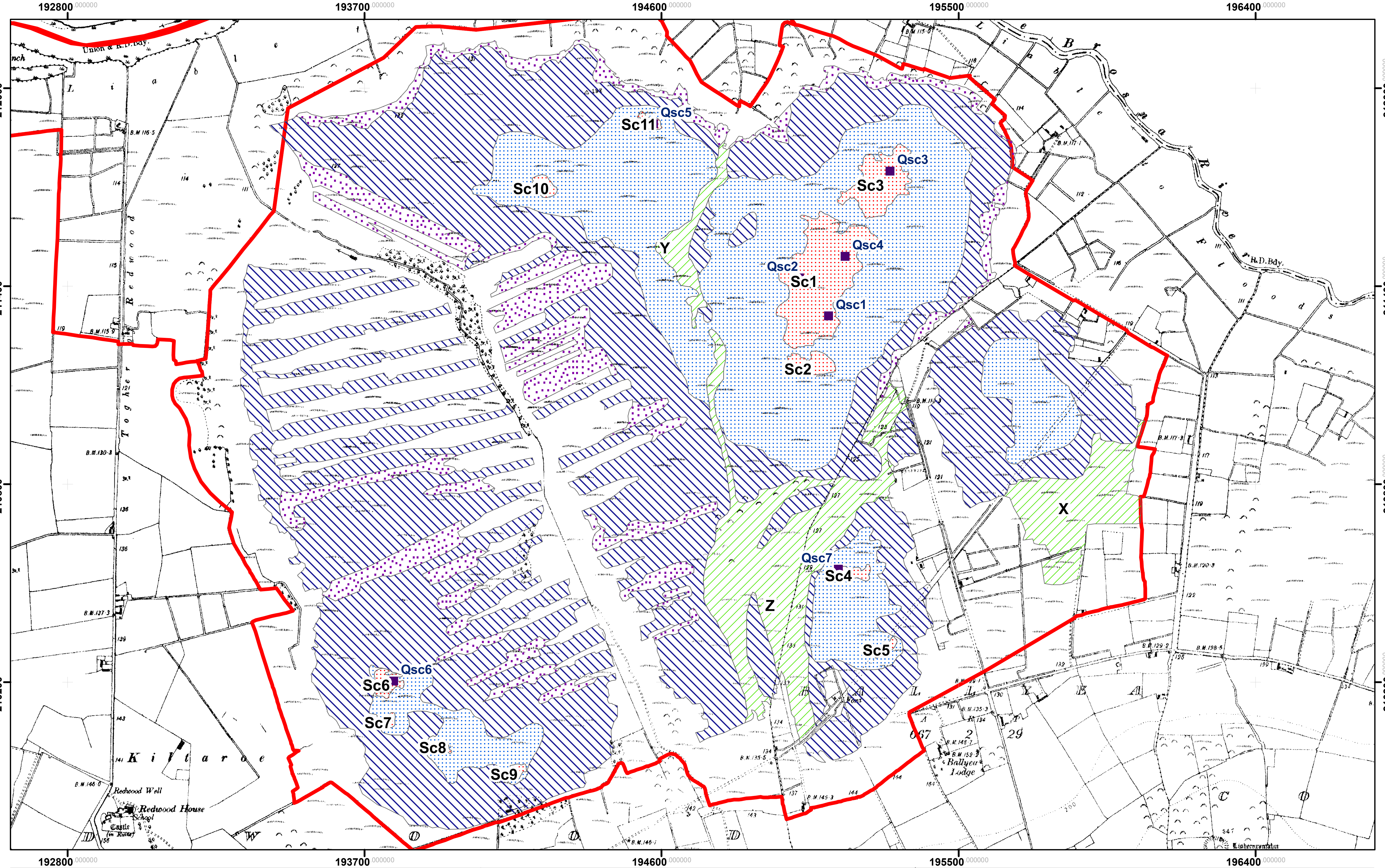
Ecotope type	**Sub-central**	**Sub-central**	**Sub-central**
Complex Name	**9/10**	**9/10rb**	**9/10**
Quadrat Name	Qsc5	Qsc6	Qsc7
Easting	194575.34	193788.28	195136.17
Northing	211891.20	210202.74	210541.60
Date	19/09/2012	20/09/2012	20/09/2012
Firmness	Soft	Very soft	Soft
Burnt	No	Severe	No
Algae in hollows %	Absent	Absent	Absent
Algae in pools %	Absent	Absent	Absent
Bare peat %	4-10	4-10	Absent
High hummocks %	Absent	1-3 (many indiv)	Absent
Low hummocks %	51-75	76-90	34-50
Hollows %	26-33	4-10	4-10

Ecotope type	**Sub-central**	**Sub-central**	**Sub-central**
Complex Name	**9/10**	**9/10rb**	**9/10**
Lawns %	Absent	Absent	11-25
Pools %	Absent	Absent	Absent
Pool type	Absent	Absent	Absent
S.austinii hum type	Absent	Relic	Absent
S.austinii hum %	Absent	4-10	Absent
S.austinii height(cm)	Absent	21-30	Absent
S.fuscum hum type	Absent	Absent	Absent
S.fuscum hum %	Absent	Absent	Absent
S.fuscum height(cm)	Absent	Absent	Absent
Leucobryum glaucum	Absent	Absent	Absent
Trichophorum type	Tussocks	Absent	Flats
Trichophorum %	4-10	Absent	1-3 (few indiv)
S.magellanicum %	26-33	11-25	11-25
S.cuspidatum %	1-3 (many indiv)	4-10	1-3 (many indiv)
S.papillosum %	1-3 (many indiv)	1-3 (many indiv)	26-33
S.denticulatum %	Absent	Absent	Absent
S.capillifolium%	4-10	1-3 (many indiv)	4-10
S.tenellum %	11-25	Absent	1-3 (many indiv)
S.subnitens %	Absent	1-3 (many indiv)	Absent
R.fusca %	Absent	Absent	Absent
R.alba %	4-10	1-3 (few indiv)	11-25
N.ossifragum %	Absent	4-10	1-3 (few indiv)
Sphag pools %	Absent	Absent	Absent
Dominant pool Sphag			
Sphag lawns %	Absent	Absent	Absent
Sphag humm %	34-50	11-25	26-33
Sphag holl %	4-10	4-10	4-10
Total Sphag %	51-75	26-33	51-75
Hummocks indicators	Absent	S.austinii	Absent
Cladonia portent %	1-3 (many indiv)	Absent	4-10
Other Cladonia sp			
C. panicea %	Absent	Absent	Absent
Calluna cover %	4-10	4-10	11-25
Calluna height(cm)	11-20	0-10	11-20
Other NotableSpecies	V. oxy, Erica(25%)	S. austinii part	myrica gale 4-10

Ecotope type	**Sub-central**	**Sub-central**	**Sub-central**
Complex Name	**9/10**	**9/10rb**	**9/10**
	E.vag (34-50%)	active/relic. Burnt Sphag cover 34-50%. E. vag 11-25%	
Other comment	S. fuscum/austinii adj to quad		

Note: Data for those 2004 quadrats re-surveyed in 2012 is given to the right of the original 2004 quadrat data in table above. Not all quadrats reported in 2004 were re-surveyed in 2012. Nonetheless, all 2004 quadrat data is given above. Additional quadrats were recorded where necessary. Some 2004 quadrats may have been classified under a different ecotope category in 2012; further detail is given within the report.

Appendix IV Survey maps



Raised Bog Monitoring & Assessment Survey 2013

Map 1: Ecotopes Map and Quadrats

Ordnance Survey Ireland Licence No EN 0059208

Ecology and Environmental Consultants Ireland Ltd.

Redwood SAC (002353)

Co.Tipperary

1:11,000

0 135 270 540 810 1,080 Meters

N

Legend

Quadrat

Ecotope type

Central

Sub-central

Bog Woodland

Active Flush

Sub-marginal

Marginal

Inactive Flush

Woodland

Face bank

Open water

Conifer plantation

Clear felled area

SAC

Raised Bog Monitoring & Assessment Survey 2013

Map 2: Vegetation community complexes

Ecology and Environmental Consultants Ireland Ltd.

Redwood SAC (002353)
Co.Tipperary

1:11,000

N

0 155 310 620 930 1,240 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

192800 193700 194600 195500 196400

212000 211400 210800 210200

Raised Bog Monitoring & Assessment Survey 2013

Map 3: Impacts (High bog drainage; Turf cutting;Fire events)

Ecology and Environmental Consultants Ireland Ltd.

Redwood SAC (002353)
Co.Tipperary

1:11,000

N

0 155 310 620 930 1,240 Meters

Legend

High Bog drainage

- Blocked:non-functional
- Blocked:reduced functional
- Not blocked:functional
- Not blocked:non-functional
- Not blocked:reduced functional
- SAC
- Burnt high bog (2004/05-12/13)
- High bog cutaway (2004/05-10)