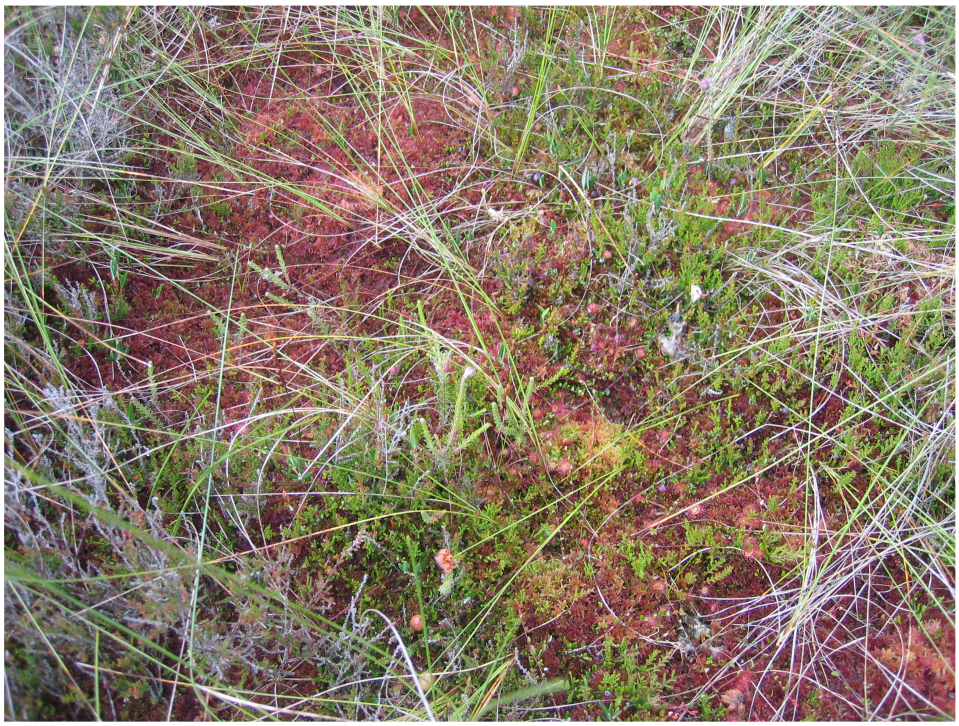
Killamuck Bog (Abbeyleix, Co. Laois) High Bog Ecological Survey



Survey commissioned by Bord Na Móna

Ecologic Environmental & Ecological Consultants Ltd

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EXECUTIVE SUMMARY

Killamuck bog located to the south of Abbeyleix town is the most south-eastern Raised Bog in county Laois. The total extent of the High Bog at Killamuck bog is over 100 ha. Although the margins of the bog were extensively cutaway in the past, turf cutting no longer takes place. Restoration works involving the blockage of High Bog drains took place in early 2009 after approximately two decades of drainage.

The survey of Killamuck bog, carried out in July 2009, consisted of a vegetation survey of the High Bog, and the recording of impacting activities such as drainage and the presence of invasive species. High Bog vegetation was described and mapped based on Raised Bog ecotope vegetation community complexes. The following habitats described in Annex I of the European Habitats Directive (92/43EEC) were found on Killamuck High Bog: Active Raised Bog, (priority habitat), Degraded Raised Bog and Depressions on peat substrates of the Rhynchosporion.

Active Raised Bog, which accounted for 1% of the High Bog area, was found on the wettest sections of the High Bog and featured high cover of *Sphagnum* mosses necessary for the generation of new peat and bog growth. This habitat was characterised by a complex micro-topography consisting of low hummocks and hollows. Higher plant species found on this habitat included: Common Cottongrass, White Beak-sedge, Bog Asphodel, Great Sundew, Round-leaved Sundew, Bog rosemary, Cranberry, Hare's-tail Cottongrass, Deergrass, Ling Heather and Cross-leaved Heath.

Degraded Raised Bog, which covered the largest portion of the High Bog, was drier than Active Raised Bog and supported lower density of *Sphagnum* mosses, higher cover of Ling Heather, Cross-leaved Heath, Bog Asphodel and Deergrass and poorer micro-topography.

Depressions on peat substrates of the Rhynchosporion habitat was found throughout the High Bog in wet areas such as hollows and *Sphagnum* moss lawns.

Scots Pine and Downy Birch were found scattered throughout the entire High Bog. A relatively large area of wet semi-natural Downy Birch dominated woodland was found to the east of the High Bog. This section of the site does not seem to have been cutaway in the past and thus vegetation gently grades from typical High Bog vegetation to wet woodland. In addition, mature mixed (mainly coniferous) woodland was found surrounding Killamuck Bog.

Invasive species such as Rhododendron, Cherry Laurel and Purple pitcher plant were found on Killamuck bog, mainly in cutover areas. Rhododendron was particularly frequent along the western cutover section of the site.

The main management objective is to maintain and enhance priority habitat Active Raise Bog at the site. Overall good future prospects are expected for all three Annex I habitats at the site; this is evident from the infilling processes taking place within recently blocked drains.

1. SITE IDENTIFICATION

Designation type	Not designated	**6" Sheet:**	LA 29
Grid Ref.:	2433700 / 182600	**1:50,000 Sheet:**	60
High Bog area (ha):	109		
Dates of Visit:	22/23-07-09		
Townlands:	Abbeyleix Demesne, Ballymulen, Clonken, Killamuck		

2. SITE LOCATION

Killamuck bog is located approximately 2.5km south of Abbeyleix. The main entrance to the site is located to the north of the bog, at the edge of Abbeyleix town. The N8 runs parallel to the western section of the bog. Killamuck Bog is located more than 10km from any other known Raised Bog within the county and is approximately 14km to the southeast of Knockacoller Bog (SAC 2333).

3. DESCRIPTION OF THE SURVEY

The survey of Killamuck bog, carried out on July 22nd and 23rd 2009, involved a vegetation survey of the High Bog, and the recording of impacting activities such as drainage and the presence of invasive species. High Bog vegetation was described and mapped based on Raised Bog ecotope vegetation community complexes developed by Kelly *et al*. (1995). The description of cutaway vegetation was also reported, although it was not systematically recorded.

Restoration work involving the blockage of High Bog drains took place in early 2009. This survey and the vegetation maps produced as part of it are the basis to assess the changes in, and recovery of, the High Bog vegetation after approximately two decades of drainage. This survey data could be used as baseline data to monitor these changes. A list of photographical records and their description are given in Appendix I; their location is shown in Map 3. Information on quadrats that were recorded during the survey is given in Appendix II.

4. DESCRIPTION OF THE HIGH BOG

Killamuck Bog is the most south-eastern Raised Bog in county Laois and contains the most south-eastern known example of Active Raised Bog (EU code 7110), priority Annex I habitat within the Habitats Directive (Council Directive 92/43/EEC), in the county. A disused railway line (part of the former Portlaoise to Kilkenny line) runs north to south through the centre of the bog and splits Killamuck Bog into two sections. The railway tracks have been removed and the old line is now used by the local community of Abbeyleix for walking/recreation

purposes. The bog is oval in shape. The total extent of the High Bog is 109ha. It is approximately 1 km wide (east to west) and 1.7 km long. The eastern section (42.6ha) is relatively smaller than the western section (66.4ha).

A large mature mixed (mainly coniferous) woodland is located to the west of the High Bog. A mature Scots Pine (*Pinus sylvestris*) and Downy Birch (*Betula pubescens*) woodland also fringes the eastern and northern sections of the site. There is a large quarry operating on a ridge to the east of the site. A stream that flows south, eventually entering the Owenbeg River, a tributary of the Nore River, drains the bog.

The entire High Bog margin has been cutaway; however turf cutting is no longer taking place at the site. A small section to the east of the High Bog appears not to have been cut away. A Downy Birch dominated woodland which receives water from the adjacent eastern section of the bog is found here, the woodland is very wet and waterlogged in places.

5. ECOLOGICAL INFORMATION

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

The following EU Annex I habitats are found on Killamuck Bog; Active Raised Bog (EU code 7110), Degraded Raised Bog (EU code 7120) and Depressions on peat substrates of the Rhynchosporion (EU code 7150). The following summary description relates to the 2009 survey.

5.1.1. Active Raised Bog (7110)

There is 1.12 ha of Active Raised Bog habitat on the High Bog at Killamuck Bog consisting of the sub-central ecotope only (See Map 1), which accounts for 1% of the High Bog area. Four isolated sample of this active peat forming ecotope are present; the eastern lobe being the wettest example and also the one with the largest extent of sub-central ecotope.

Overall sub-central ecotope at the site is characterised by a micro-topography consisting of low hummocks and hollows, where pools are absent. *Sphagnum* spp. cover varies from 70% to 80% and *Sphagnum capillifolium* dominates the moss layer. *Sphagnum papillosum, Sphagnum subnitens, Sphagnum imbricatum* and *Sphagnum fuscum* form hummocks and *S. cuspidatum* is found in the hollows. Sub-central ecotope samples are located either in depressions or flat areas were water from the surrounding High Bog accumulates.

White Beak-sedge (*Rhynchospora alba*), Bog Asphodel (*Narthecium ossifragum*) and Hare's-tail Cottongrass (*Eriophorum vaginatum*) characterised the sub-central ecotope vegetation at the site. Ling Heather (*Calluna vulgaris*) and Cross-leaved Heath (*Erica tetralix*) are also common. Additional species found include Bog Rosemary (*Andromeda polifolia*), Great Sundew (*Drosera anglica*), Round-leaved Sundew (*Drosera rotundifolia*) and Cranberry (*Vaccinium oxycoccos*). Scots Pine and Downy Birch are also present.

Generally, there appear to be good prospects for this Annex I habitat at the site as the infilling process already taking place within recently blocked drains illustrates.

5.1.2. Degraded Raised Bog (7120)

There is 107.9 ha of degraded Raised Bog on the High Bog at Killamuck Bog composed of sub-marginal, marginal and face-bank ecotopes (See Map 1), which accounts for 99% of the High Bog area. Face-bank ecotope dominates large sections of the site, particularly along the western lobe (See Map 1).

Face-bank ecotope is characterised by firm ground, tall Ling Heather, poor *Sphagnum* cover and flat micro-topography, where hollows and hummocks are only very occasionally found. This ecotope is commonly found adjacent to recently blocked drains and expands into the central sections of the High Bog as a result of drying out caused by drainage. Small scattered patches of marginal ecotope are also found within the face-bank ecotope.

Marginal ecotope, slightly wetter than the face-bank ecotope and with lower vegetation growth (particularly lower heather growth), covers large sections of High Bog on the western lobe and surround sub-marginal ecotope on the eastern lobe. A large section of the western lobe consists of marginal / sub-marginal ecotopes mosaic, with the latter forming long strips of vegetation between drains. Micro-topography consists of low hummocks, flats and very occasionally hollows. *Sphagnum* cover is generally lower than 10%.

Sub-marginal ecotope covers large sections of the eastern lobe. This ecotope micro-topography is more developed than the marginal ecotope with higher presence of hummocks and hollows and higher *Sphagnum* cover (up to 30%). Very occasionally *S. imbricatum* and *S. fuscum* hummocks are found, but *S. capillifolium* dominates. *S.papillosum*, *S. tenellum, S. cuspidatum* and *S. subnitens* are also present. Bog Myrtle (*Myrica gale*) and Purple Moor-grass (*Molinia caerulea*) is also found at the edges of the High Bog within the sub-marginal ecotope. Scots Pine and Downy Birch are common throughout the habitat and characterise some of the ecotopes particularly along the eastern section of the eastern lobe.

Generally, there appear to be good prospects for this habitat at the site, indicated by the infilling of drains within some sections of sub-marginal ecotope (e.g. GR: 244008 / 182269).

5.1.3. Depressions on peat substrates of the Rhynchosporion (7150)

Rhynchosporion vegetation occurs at Killamuck Bog, but it was not mapped separately and its extent was not calculated. It is likely, however, that the habitat covers no more than a couple of hectares. Areas of the Rhynchosporion vegetation are largely confined to hollows and *Sphagnum* lawns in sub-marginal (vegetation complex 7/4) and sub-central (vegetation complex 10/4) ecotopes. Rhynchosporion also dominates the vegetation in erosion channels in areas of degraded Raised Bog at the edge of the High Bog.

5.1.4. Bog Woodland (91D0)

There is no Bog Woodland present on Killamuck Bog High Bog.

5.2. Detailed vegetation of the High Bog

The following vegetation description was taken during the 2009 survey of Killamuck Bog. Vegetation at the High Bog is divided into a number of community complexes, which are listed and described within this section of the report based on the dominant species. These community complexes are grouped into ecotope types. The distribution of the ecotopes is shown on the ecotope map (Map 1). The community complexes are displayed on the complex map (Map 2). Mapping of ecotopes at Killamuck Bog High Bog vegetation is particularly complicated as a result of the variation in vegetation complexes within small areas due to the effect of drainage over the last two decades. Occasionally more than one ecotope is found between drains which are generally fifteen to twenty metres apart. Face-bank ecotope frequently occurs adjacent to the drains and grades into marginal and occasional sub-marginal towards the centre of the bog.

The complexity of Killamuck Bog High Bog made the mapping process more difficult due to the abundance of mosaic vegetation consisting of a combination of ecotopes. One area of the bog was mapped as marginal ecotope with sub-marginal strips (See Map 1). However, the general protocol was to map the High Bog section as the most dominant ecotope present, despite smaller patches of other ecotopes being present. A total of four vegetation quadrats (i.e. relevés) were recorded during the vegetation survey within sub-central ecotope. Their location is shown on Map 1 and a detailed description of their content is given in Appendix II.

5.2.1. Active Raised Bog

Central Ecotope Complexes

Absent from Killamuck Bog.

Sub-Central Ecotope Complexes

Complex 10/4

This active peat forming vegetation complex was recorded on the western lobe of the site. It covers a very small section of the High Bog (0.13ha). It is located in a shallow depression where the ground is very soft. Blocked drains where infilling is taking place are present. Micro-topography consists of low hummocks and hollows, pools are absent. Overall *Sphagnum* cover is 70% with *S. capillifolium* hummocks amounting to 50% and *S. papillosum* 10%. White Beak-sedge and Hare's-tail Cottongrass are found in hollows with 25% and <5% cover respectively. *Sphagnum cuspidatum* was also recorded in hollows. *Cladonia* cover is low (1%). Ling Heather cover reaches 10% and is less than 0.2m in height. *Sphagnum fuscum* hummocks are present as well as Great Sundew and Bog rosemary. Scattered Scots Pine saplings (<1m in height) are also present. Quadrat 1 (**Qsc1**) was recorded within this complex and its location is shown on Map 1. A detailed description is given in Appendix II.

This complex is again present in a depression on the northern section of the eastern lobe. Although drains are present, in-filling by *Sphagnum cuspidatum* is already taking place and the area is considered to be getting wetter. Micro-topography consists of low hummocks and hollows. Overall *Sphagnum* cover reaches 75%, mainly hummocks (70%) of *S. capillifolium* (60%) and *S. papillosum* (10%), although *S. papillosum* is also found within hollows along with *S. cuspidatum*. Other species within this section include White Beak-sedge, Hare's-tail Cottongrass, Bog Asphodel, Bog rosemary, Cross-leaved Heath, Round-leaved Sundew, Cranberry and Scots Pine. Quadrat 2 (**Qsc2**) was recorded within this complex and its location is shown on Map 1. A detailed description is given in Appendix II.

Complex 10/9

This sample of sub-central ecotope is located in the middle section of the eastern lobe (GR: 243983 / 182330). This area consists of a small patch (0.086ha) of very wet ground slightly depressed with high *Sphagnum* cover (80%), mostly *S. capillifolium* lawns and low hummocks (60%) with Cranberry and Bog rosemary. *Sphagnum papillosum* is found forming hummocks and within hollows (20%). Hare's-tail Cottongrass tussocks are also common (40% cover). Micro-topography consists of low hummocks and hollows. Ling Heather (0.2m in height) and Cross-leaved Heath reach 25% cover. This sample of active peat forming ecotope has flush-like characteristics as the presence of *Polytrichum alpestre* hummocks indicate. Scots Pine

and Downy Birch are also present. Quadrat 3 (**Qsc3**) was recorded within this complex and its location is shown on Map 1. A detailed description is given in Appendix II.

Complex 10/9/6

This vegetation complex located on the southern section of the eastern lobe covers the largest section of sub-central ecotope in the site (0.67ha). The ground is generally soft and flat. This area is likely to collect water from the western section of the High Bog as a gentle slope towards this active peat forming ecotope was noted. Micro-topography consists of low hummocks and hollows. Overall *Sphagnum* cover is 70% with 60% being made up of mainly *S. capillifolium* and *S. papillosum* hummocks and 10% *S. cuspidatum* hollows. Hare's-tail Cottongrass dominates (30%) and Bog Asphodel (10%) was also recorded. Ling Heather cover reaches 25%. Patches of sub-marginal ecotope (complex 9/7/6) are also present within this section of sub-central ecotope. Quadrat 4 (**Qsc4**) was recorded within this complex and its location is shown on Map 1. A detailed description is given in Appendix II.

5.2.2. Degraded Raised Bog

Sub-Marginal Ecotope Complexes

Complex 7/6/4

This complex was found covering a small section of the High Bog along the northern section of the western lobe (GR: 243680 / 1783260). This area, located in a shallow depression, remains wet, despite narrow drains (0.4 x 0.4m) being present, which have not been blocked. Ground is firm to soft in places. Ling Heather reaches up to 0.3m in places, *Cladonia* cover is high (30-50%), *Sphagnum* cover is rather patchy and reaches 30% in places. Micro-topography consists of lawns, hollows and small hummocks, pools are absent. Ling Heather and Cross-leaved Heath dominate this complex (40% cover). Bog Asphodel (10% cover) and White Beak-sedge (5 -10% cover) are also commonly found. Accompanying species include Common Cottongrass (*Eriophorum angustifolium*) (<5% cover), Deergrass (*Trichophorum cespitosum*) (<5% cover), Bog rosemary and Round-leaved Sundew (*Drosera rotundifolia*). The mosses *Hypnum jutlandicum*, *Dicranum scoparium* and *Campylopus introflexus* are also present. *Sphagnum* species found include *S. capillifolium, S. tenellum and S. papillosum* forming hummocks and *S. cuspidatum* in hollows. *S. imbricatum* hummocks were also recorded. Scots Pine and Downy Birch saplings are frequently found within this complex and reach 0.5m in height. This vegetation complex is also found along the western edge of the western lobe (GR: 243450 / 182845) where it grades into complex 7/4 which is described below.

Complex 7/4

This complex was found along the western edge of the western bog lobe. A gentle slope towards the cutaway characterises this section of the bog. This complex is very similar to complex 7/6, however White Beak-sedge becomes more frequent and *Sphagnum* cover ranges from 10 to 20%. Bog Myrtle is found close to the cutaway. *Sphagnum imbricatum* hummocks along with Cranberry were also recorded. This complex dominates the western section of the largest sub-marginal ecotope sample on the western lobe and grades into complex 7/9 (characterised by wetter ground), towards the sub-central ecotope sample.

Both complexes 7/4 and 7/9 were also found within marginal ecotope along the area mapped as marginal (sub-marginal strips) (see Map 1). Strips of these sub-marginal ecotope complexes up to 4m wide are frequently recorded in between the blocked drains in this area. Narrow sections of face-bank ecotope are also found running parallel to blocked drains within sub-marginal ecotope.

Complex 7/4 was also recorded on the northern section of the eastern lobe (GR: 243981 / 1822707). *Sphagnum imbricatum* hummocks were recorded very occasionally. The ground becomes very soft near the blocked drains close to the northeast sample of sub-central ecotope (see Map 1: Qsc2) where evidence of infilling was noted. This indicates good prospects of recovery for this section, where small patches of sub-central ecotope (vegetation complex 10/4) were recorded within sub-marginal ecotope.

Complex 7/9

This complex dominates the largest sample of sub-marginal ecotope in the western lobe. Ground is soft and Ling Heather reaches 0.3m in height. Micro-topography is characterised by flats, low hummocks and shallow hollows, pools are absent. *Sphagnum* cover grades from 20 to 25% and mainly consists of *S. capillifolium*, however *S. papillosum* is also found. Ling Heather and Cross-leaved Heath dominate this complex (40% - 50% cover). Other species include Hare's-tail Cottongrass (5-10% cover), Common Cottongrass (5%), Bog Asphodel (5%), and White Beak-sedge (<5%) in shallow hollows. Bog rosemary, Round-leaved Sundew and the moss *Campylopus* sp. are also present. *Cladonia* cover reaches 25% in places. Scattered Scots Pine and Downy Birch trees (<2m) are also present.

This vegetation complex is also found along with 7/4 on the northern sample of sub-marginal ecotope on the northern lobe (GR: 244032 / 182705). Samples of this complex to the east of the northeast sample of sub-central ecotope (see Map 1: Qsc2) are characterised by very soft and wet ground; *Sphagnum capillifolium, S. papillosum*, and Cranberry hummocks were noted here, as well as Ling Heather (0.4m) and scattered Scots pines.

This vegetation complex becomes slightly drier towards the centre of the eastern lobe (GR: 244048 / 182503) where Scots Pine density increases; the complex was mapped as **7/9+Pine**. The section immediately north of the third patch of sub-central ecotope (see Map 1: Qsc3) features drier ground and tall Ling Heather dominates, this area was mapped as marginal ecotope (**complex 7 + Pine**). Complex 7/9 grades into 7/9+My towards the eastern edge of the eastern lobe, close to the wet Downy Birch woodland (GR: 277068 / 182463). Complex 7/9+My features very similar vegetation to 7/9, but Bog myrtle and *Sphagnum* hummocks become more frequent. *Polytrichum alpestre* hummocks are also present.

Complex 7 + *Molinia/Myrica*

Vegetation complex 7/9 grades into Complex 7 + *Molinia/Myrica* along the north-eastern edge of the eastern lobe, where a gentle slope towards the edge of the bog was noted (GR: 244202 / 182648). Ling Heather; Purple Moor-grass, Cross-leaved Heath, Bog Myrtle and *Sphagnum capillifolium* hummocks characterise this vegetation complex.

Marginal Ecotope Complexes

Complex 7

This complex dominates the marginal ecotope section of the western lobe and is found along the western section of the eastern lobe, near the railway track. The ground grades from firm to soft in places. Ling Heather (0.3 to 0.4m) dominates with up to 80% cover. *Cladonia* cover is low (1%). Micro-topography consists of hummocks and hollows, tussocks are generally absent. Pools are absent. Other species present include: Cross-leaved Heath (5% cover), Hare's-tail Cottongrass and Common Cottongrass (1%). *Hypnum jutlandicum* hummocks (5%) are found within tall Ling Heather. Bog rosemary, White Beak-sedge (<5%) and *Campylopus introflexus* are also present. Overall *Sphagnum* cover is 10% and mostly consists of *S. capillifolium*. Scattered Scots Pine trees are also present (<2m).

This vegetation complex is also found dominating a large area in the northern section of the eastern lobe (GR: 243926 / 182858). Here the ground is firm to soft. A gentle slope towards the edge of the bog was recorded. Micro-topography consists of low hummocks, flats and hollows. Pools are absent. Average *Sphagnum* cover is 10%. *Cladonia* (*C. portentosa, C. floerkeana* and *C. crispata)* cover reaches 20% in places. Very occasionally Deergrass tussocks are found (1% cover). Evidence of disturbance such as bare peat, *Campylopus introflexus* and *Dicranum scoparium* are present. Ling Heather (up to 0.4m in height) characterise this complex (50% cover). Cross-leaved Heath (20% cover), *Hypnum jutlandicum* (50% in places) and Bog Asphodel (<5%) were also present. Other species recorded include Bog rosemary and Common Cottongrass. Hollows are dominated by White Beak-sedge, Bog Asphodel, *S. papillosum* and *S. capillifolium* which also forms hummocks.

Scattered Scots Pine (<2m) and Downy Birch (<2.5m) are also present. Occasionally small patches of wetter sub-marginal complexes 7/4 and 7/9 were found within this marginal ecotope. The vegetation adjacent to blocked drains occasionally corresponded to complex 1 (face-bank ecotope), however vegetation complex 7 dominates. This complex is also found along the southern edge of the eastern lobe (GR: 243851 / 181857). Here Cross-leaved Heath and up to 40% cover of *Cladonia* (mostly *C. portentosa*) characterise the vegetation. White Beak-sedge is found within erosion channels.

Complex 7/6+Pines

This complex is found surrounding the large area of sub-marginal ecotope on the southern section of the eastern lobe. The ground is firm to soft near hollows and it is characterised by a slight slope. Micro-topography consists of flats, low hummocks and hollows. Pools are absent and overall *Sphagnum* cover is 5%. Ling Heather (0.3m) along with Cross-leaved Heath dominates (40%). Other species present include Bog Asphodel (10%), White Beak-sedge (5-10%), Harestail Cottongrass, Deergrass, Round-leaved Sundew and *Campylopus introflexus*. *Cladonia* spp. cover reaches 5%. Scots Pine and Downy Birch trees are frequently found. The density of Scots Pine is reduced within some sections of this complex across the southern section of the eastern lobe and there this complex is mapped as **complex 7/6**. Although the south-western section of the eastern lobe (GR: 243861 / 182047) has been mapped as marginal ecotope, occasionally small patches of sub-marginal ecotope (complexes 9/7/6 and 9/7) were recorded.

Facebank Complexes

Complex 1

This complex characterised by Ling Heather (average 0.4 to 0.5m, up to 0.7m in places) dominates large sections of the western lobe and it is also found along the edges of the eastern lobe (see Map 1). It is characterised by firm ground, and occasional bare peat patches. Overall Ling Heather dominates with up to 85% cover, other species found include Cross Leaved-heath, Common Cottongrass, Bog rosemary, White Beak-sedge, Deergrass and Bog Asphodel. Scots Pine trees (up to 3m) and Downy Birch saplings are frequent. *Cladonia* species include *C. portentosa, C. floerkeana, C. cervicornis* and *C. crispata*. Mosses include *Dicranum scoparium*, *Campylopus introflexus,* and *Hypnum jutlandicum*. Overall *Sphagnum* cover is less than 5%. Micro-topography is characterised by flats with very occasional *S. capillifolium* hummocks. Areas dominated by bare peat are occasionally found where peat has been dug out to build dams.

Small patches of wetter marginal ecotope can be found within this complex, where *Sphagnum capillifolium* cover increases. Hollows are also present with species such as S. *cuspidatum, S. papillosum, S. magellanicum, S. subnitens, S. fuscum,* Bog asphodel, White Beak-sedge and Round-leaved Sundew. Overall, these sections were mapped as face-bank ecotope as the extent of these wetter patches was too small to map as a marginal ecotope. Although not mapped, these wetter sections, which are frequently found in between blocked drains, were recorded as **complex 1+**. Purple pitcher plant (*Sarracenia purpurea*) was reported in one of these sections (GR: 243496 / 182813). The southern section of the western lobe contains a large area dominated by complex 1. Although this area was not thoroughly surveyed due to time constraints, visual validation from adjacent areas and the 2005 aerial photograph indicate that this section, heavily drained, consists of tall Ling Heather and was therefore mapped as complex 1 (face-bank ecotope).

5.3. Adjacent habitats

Although large areas of mature Scots Pine and Downy Birch woodland surround the High Bog, these habitats were not part of the scope of the survey and were therefore not surveyed.

A large section of wet semi-natural Downy Birch dominated woodland is located to the east of the eastern lobe (see Map 1). This section of the site collects water from the surrounding High Bog to the west and consists of 2.67ha of wet woodland on acid peat with a high water table. This section of the site seems not to have been cutaway in the past and thus vegetation gently grades from High Bog sub-marginal ecotope to wet woodland. Downy Birch trees up to 4m high dominate the canopy, Grey Willow (*Salix cinerea*) is also found. Ling Heather, Bog Myrtle and Common Reed (*Phragmites australis*) dominate the field layer. Ground flora is characterised by Purple Moor-grass tussocks, *Carex rostrata*, Tormentil (*Potentilla erecta*), *Hypnum jutlandicum, Polytrichum commune* and *Sphagnum palustre* hummocks.

The wet woodland is likely to correspond to Bog Woodland (WN7) in Fossitt (2000) and *Molinia caerulea – Potentilla erecta* vegetation type within *Betula pubescens – Molinia caerulea* group described by Perrin *et al*. (2008). This woodland type does not correspond to Annex I habitat Bog Woodland (EU code 91D0) because of the low *Sphagnum* species cover and low *Sphagnum* species diversity.

5.4. Regenerating cutover

Some sections of cutover at Killamuck bog were surveyed from the High Bog in order to find areas were peat regeneration was taking place and to record the presence of invasive species, particularly Rhododendron (*Rhododendron ponticum*). A systematic and thorough survey of the site cutover was not part of the scope of the survey.

Regenerating cutover was recorded only in a few locations along the northern section of both western and eastern lobes (GR: 243556 / 183275; 243630 / 183315; 243921 / 182970) (see

Map 1). *Sphagnum* lawns infill drains in these sections and in the eastern lobe they expand over the cutover.

The remaining surveyed cutover does not contain regenerating peat and mainly consists of stands of Scots Pine and Downy Birch. Rowan (*Sorbus aucuparia*), Bog Myrtle, Ling Heather, Bracken (*Pteridium aquilinum*), Grey Willow, Gorse (*Ulex europaeus*) and Purple Moor-grass are also common. A stream runs along the northern section of the eastern lobe (GR: 244031 / 182966). Here cutover consists of a Scots Pine / Downy Birch stand with Almond Willow (*Salix triandra*), Remote Sedge (*Carex remota*), *Scleropodium purum*, *Sphagnum capillifolium* hummocks, *Sphagnum palustre*, Bilberry , Meadowsweet (*Filipendula ulmaria)* and Fool's Water-cress (*Apium nodiflorum)*.

6. IMPACTS AND ACTIVITIES IN AND AROUND THE SITE

6.1. Drainage

6.1.1. High Bog Drainage

Killamuck Bog High Bog is characterised by a dense drainage network with a total length of more than 66km. Drain dimensions vary from 0.4m x 0.4m to a few large drains of higher dimensions (2.5m x 2.5m and 2m x 1.5m). The average drain dimension is 1m x 0.75m[1]. All drains, except for a few narrow drains on the northern section of the western lobe, were blocked in Spring 2009. Evidence of infilling by *Sphagnum cuspidatum* and algae were recorded in several drains and this is illustrated on Map 3. All drains surveyed were almost full of standing water on the day of the site visit in July 2009.

6.1.2. Bog Margin Drainage

No drains were surveyed in the cutover areas during this survey. Large drains running parallel to the railway track that splits the High Bog in two lobes were not thoroughly surveyed but the western of these drains feature some peat dams and standing water. The drains on the eastern side of the track contained flowing water despite the presence of some dams.

6.2. Fire History

No evidences of recent fire were recorded on the site.

[1] Note: individual drains dimensions are provided as part of the digital shapefile format files produced as part of the report.

6.3. Afforestation

Large conifer plantations are present to the north and west of the site. These areas were not surveyed. Scots Pine has encroached all over the High Bog and it is present along with Downy Birch in practically the entire High Bog. The highest density of trees was noted along the eastern and south-eastern sections of the High Bog.

6.4. Other Impacts and Damaging Activities

Bare patches of peat caused by the construction of peat dams for the blocking of drains are present across the entire High Bog. These disturbed areas are likely to be naturally re-vegetated and covered by typical High Bog species in the near future. Some of these disturbed areas are already very wet in certain sections of the bog. It appears that the construction of these dams has little impact on the High Bog.

Invasive species were systematically recorded when found during the survey. Rhododendron is frequently found on the cutover, particularly along the western cutover section where large stands were reported. Only small individuals were occasionally found on the High Bog. This species was also reported on the northern cutover of the eastern lobe[2]. Cherry Laurel (*Prunus laurocerasus*) was also reported on the western cutover (GR: 243485 / 1822991). Purple pitcher plant (*Sarracenia purpurea*) was also reported on the western lobe (GR: 243496 / 182813). The population consisted of only a few plants.

[2] Note: invasive species location and brief description are provided as part of the digital shapefile format files produced as part of the report – see Map 3

7. FUTURE MANAGEMENT

The main management objective for the site is to enhance priority habitat Active Raise Bog (currently covering only 1% of the High Bog) in order to achieve the extent and diversity of the Annex I habitat, prior to human impacts. The conservation value of other habitats particularly cutover bog and woodlands should be maintained and enhanced where possible.

The main management objectives are as follows:

- The spreading of fires on the High Bog should be prevented. Although burning has not occurred in recent times at the site and is unlikely to happen in the future, burning is never desirable on raised bogs and can be ecologically very damaging.
- Removal of invasive species on both High Bog and cutover is recommended.
- Little active management is needed on the High Bog other than the maintenance of dams on the High Bog drains when required.
- The establishment of a monitoring programme would be desirable, in order to ascertain where changes in the vegetation may occur. The programme should include the following:
    - A similar survey to the one undertaken in 2009 should be carried out in 5 years time. The vegetation complexes should be recorded and described and the various ecotopes present should be mapped. Considerable changes in the High Bog vegetation would be expected; particularly in wet areas where active peat forming vegetation is currently present (i.e. sub-central ecotope) and also in very wet sub-marginal ecotope areas.
    - Monitoring should also include the recording of quadrats described in the 2009 survey. The recording of specific monitoring indicators such as biotic (e.g. species) and abiotic variables provide critical information on the functioning of the bog ecosystem. This monitoring will allow more accurate tracking of changes in sensitive areas of the site.
    - Monitoring should also include the assessment of changes in the recently blocked drainage system, special attention should be given to those drains where infilling processes were reported in 2009.

8. REFERENCES

Douglas, C. & Grogan, H. (1986) *Survey to locate raised bogs of scientific interest in Counties Longford, Westmeath and East Mayo.* Unpublished report, National Parks & Wildlife, Department of Environment, Heritage and Local Government, Dublin.

Fossitt, J.A. (2000) *A guide to habitats in Ireland.* The Heritage Council.

Kelly, L., Doak, M. & 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.

Perrin, P., Martin, J., Barron, S., O'Neill, F., McNutt, K. & Delaney, A. (2008) *National Survey of Native Woodlands 2003 -2008. Volume I and II.* A report submitted to the National Parks & Wildlife Service.

Appendix I Photographical Records

Image Number	Aspect	Type	Feature	Date
150-5035	E	Overview	Blocked drainage	22/07/2009
150-5036	W	Overview	Blocked drainage	22/07/2009
150-5037	SE	Overview	Sub-central ecotope	22/07/2009
150-5038	NA	Detail	Sub-central ecotope	23/07/2009
150-5039	WN	Overview	Sub-central ecotope	23/07/2009
150-5040	E	Overview	Infilling drainage	23/07/2009
150-5041	NA	Detail	Sub-central ecotope	23/07/2009
150-5042	SE	Overview	Sub-central ecotope	23/07/2009
150-5043	NA	Detail	Sub-central ecotope	23/07/2009
150-5044	WN	Overview	Sub-central ecotope	23/07/2009
150-5045	SW	Overview	Very degraded area left by machinery	23/07/2009

Appendix II Quadrats

COMPLEX NAME	10/4	10/4	10/9	10/9/6
GPS READING	243483E, 182602N	244106E, 182732N	243990E, 182338N	244052E, 182094N
QUADRAT NAME	Qsc1	Qsc2	Qsc3	Qsc4
FIRMNESS	Very soft	Very soft	Very soft	Very soft
CRACKING	no	no	no	no
BOG BURST	no	no	no	no
SLOPE	Depression	Depression	Depression	Flat
DRAINS	yes	yes	yes	yes
BURNT	no	no	no	no
TREND	unknown	Wetter	unknown	unknown
ALGAL HOLLOWS	0	0	0	0
ALGAL POOLS	0	0	0	0
BARE PEAT	0	0	0	0
POOL COVER	Absent	Absent	Absent	Absent
POOLS	Absent	Absent	Absent	Absent
MICRO TOPOGRAPHY	Low hummocks / hollows	Low hummocks / hollows	Low hummocks / hollows	Low hummocks / hollows
COMMUNITY				
S. CAP HUMMOCKS	50%	60%	60%	50%
S. IMBRIC HUMMOCKS	0	0	0	0
LEUCOBRYUM HUMMOCKS	0	0	0	0
TRICHOPHORUM TUSSOCK	0	5%	0	1
TRICHOPHORUM FLATS	0	0	0	0
S. PAP HUMMOCKS	10%	10%	20%	20%
S. PAP HOLLOWS	0	10%	20%	0
S. MAG HUMMOCKS/LAWNS/HOLLOWS	0	0	0	0
S. MAG HABITATS	0	0	0	0
S. CUSPIDATUM/E. ANG POOLS	0	0	0	0
R. FUSCA HOLLOWS	0	0	0	0
R. ALBA HOLLOWS	25%	20%	1%	2%
E. VAGINATUM HOLLOWS	<5%	0	0	0
NARTHECIUM	5%	5%	0	5%
NARTHECIUM LAWNS	0	0	0	5%
S. MAG / S. CUSP POOLS	0	0	0	0
S. SUBNITENS	0	0	0	0
S. AURIC POOLS	0	0	0	0
S. FUSCUM HUMMOCKS	0	0	0	0
S. CUSP	5%	1%	0	2%
SPHAGNUM POOLS/LAWNS	0	0	0	0
SPHAGNUM HUMMOCKS	60%	70%	60%	60%
TOTAL SPHAGNUM COVER	70%	75%	80%	70%
E. ANGUS	5%	1%	0	0
QUALITY INDICATORS				
HUMMOCK INDICATORS				
POOLS INDICATORS	*S. cuspidatum*	*S. cuspidatum*		*S. cuspidatum*
CLADONIA PORTENTOSA	1%	1%	1%	0
CLADONIA COVER	1%	1%	1%	0
TRICHOPHORUM TUSSOCKS	0	5%	0	0
NARTHECIUM ABUNDANT	5%	5%	0	10%
E. VAGINATUM TUSSOCKS	5%	0	40%	30%
CAREX PANICEA	0	0	0	0
S. MAGELLANICUM ABUNDANT	0	0	0	0
CLADONIA FLOERKEANA	1%	0	0	0
OTHERS % DISTURBANCE	Absent	Absent	Absent	Absent
TEAR PATTERN	Absent	Absent	Absent	Absent
CALLUNA COVER	10%	5%	20%	25%
CALLUNA HEIGHT	0.2m	0.3m	0.2m	0.3m
OTHER DETAILS				
OTHER SPECIES				
COMPLEX VARIATIONS				
SIMILAR DESCRIPTION				
OTHER DETAILS	Sphagnum hollows 10%	Sphagnum hollows 10%	Sphagnum hollows 20%	Sphagnum hollows 10%

Appendix III Survey Maps