

RESTORING RAISED BOG IN IRELAND
Project Reference: LIFE04 NAT/IE/000121

A REPORT ON THE RESTORATION OF PROJECT SITE No. 7

DRUMALOUGH BOG, Co. ROSCOMMON



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September 2008**

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Project Site No. 7 - Drumalough Bog, Co. Roscommon

1. Introduction

Grid Reference IM6242 8199	Elevation (m) 90	Bedrock Geology Limestone
SAC Name and Number Drumalough Bog cSAC (1632) SAC Area (ha) 244	Project Site Area (ha) 43.2	Main Restoration Methods Clear-fell mature conifer crop Fell to waste young conifers Block drains with peat dams Control natural regeneration
Area of Conifer Cover (ha) 32.0	Area of Open Bog (ha) 11.2	Area of Birch Woodland (ha) 0
Noteworthy habitats/plant/animal species present Active raised bog pool system on adjoining open bog. Red Grouse, a Red listed species that is becoming rare in Ireland, has been recorded on the site		

General site description

Drumalough Bog cSAC is situated 5 km north-west of Castlerea, Co Roscommon and comprises three separate parts, which were once part of an extensive bog complex, but which are now separated by cutover bog.

The two raised bogs in this site are example of Western Raised Bog and the most frequent plant species present on the intact high bog areas include Ling Heather (*Calluna vulgaris*), Carnation Sedge (*Carex panicea*) and the moss *Racomitrium languinosum*, the liverwort *Pleurozia purpurea* and lichens (*Cladonia* spp). Hare's tail Cottongrass (*Eriophorum vaginatum*), Deergrass (*Trichophorum caespitosum*) and Bog Asphodel (*Narthecium ossifragum*) are also found here. The vegetation of the pool systems is dominated by the bog moss *Sphacnum cuspidatum*, Bogbean (*Menyanthes trifoliata*) and Marsh Lousewort (*Pedicularis palustris*). The moss *Campylopus atrovirens* is found on the margins of many pools where the water-level appears to be becoming lower. Plant species occurring on flushes include Purple Moor-grass (*Molinia caerulea*), Bog Myrtle (*Myrica gale*), Bog-rosemary (*Andromeda polifolia*), the bog moss *Sphagnum magellanicum* Soft rush (*Juncus effuses*) and Bog-sedge (*Carex limosa*) (NPWS, 2002).

Current landuse on the site consists of localised peat-cutting on the thin central area of the western site. Peat-cutting appears to have ceased on the eastern site. There are areas of commercial forestry on both areas of high bog. Damaging activities occurring on this site include burning, peat-cutting, afforestation and associated drainage. These are all activities that have resulted in the loss of habitat and damage to the hydrological status of the site (NPWS, 2002).

Project Site Description (Pre-restoration)

The project site consists of 32.0 hectares of conifer plantation on high bog and 11.2 ha of unplanted cutover bog. This project involves the two western parts, Drumalough and Cloonmaul, which are two relatively small, but very good quality, areas of raised bog. The two areas are dealt with separately in this account. **Drumalough** has a large, well-developed pool and flush system, not in Coillte ownership, while **Cloonmaul** has a smaller pool system of lesser quality.

The site was surveyed in 2003, prior to restoration, which found that at Drumalough, the conifers consisted largely of 25-year old Lodgepole Pine (*Pinus contorta*) and occur on the dome immediately adjacent to well developed pool systems (Conaghan, 2003). Two blocks of 25 year old Lodgepole Pine occurred with a felling date of 2007. One quarter was 'underdeveloped' with the remainder at yield class 12. A small area (1.7 ha) of open bog with turbary rights also occurs.

At Cloonmaul about one third (4.9 ha) of a 25 year old Lodgepole Pine plantation on the high bog, occurred within the cSAC. A good Purple Moor-grass flush occurred within the plantation. The edge of the plantation was about 40 m from a small area of pools. There was also a large area (10.5 ha) of open cut-over bog with about 20% active peat cutting. It was suggested that about 9 ha outside the present cSAC boundary be included in the restoration project (Conaghan, 2003).

About 4 ha of conifer plantation, lie outside the SAC boundary and contain a large area of poorly developed conifers with excellent restoration prospects. It would not be logical for any bog restoration project at Cloonmaul to proceed without including these conifers. One large and one small area of poorly developed conifers occur within the main plantation. In the smaller area, the ground is quite spongy and in places quaking, with remnant pools and few if any drains. The pools contain a diversity of *Sphagnum* spp including *S. magellanicum*. Bog Myrtle occurs on the large scale hummocks between pools. In the larger area a very wet *Sphagnum* carpet extends into Coillte property from private bog to the north. This grades south into an area of very poorly growing conifers with much open space and a very high water-table seen in wide *Sphagnum* filled drains (Conaghan, 2003).

Description of bog vegetation adjoining planted areas

Drumalough A very good quality pool and hummock system grading into a Purple Moor-grass flush occupies the greatest area, lying adjacent to the 500m length of one plantation edge and at one point lying between the two plantations. The diversity of species composition in the hummock/pool system is considerable indicating a well-developed, functioning habitat. Bog Myrtle is widespread but sparse. The flush begins, immediately adjacent to the plantation, as a floating mat of Purple Moor-grass and Bog Myrtle, with a *Sphagnum* lawn containing mud sedge (*Carex limosa*). The remainder of the dome habitat is undifferentiated bog with a spongy cover of *Sphagnum* spp (especially *S. capillifolium* hummocks), Ling Heather (*Calluna vulgaris*) and Hare's tail Cottongrass (*Eriophorum vaginatum*), but showing signs of drying (e.g. Carnation Sedge is frequent in depressions). Between flushed areas in the north-west of the site the bog

surface has a large scale hummock/hollow system with a topography of at least one metre. A small area of vegetated, wet cut-over bog occurs, with large hummocks of mosses such as *Polytrichum commune*, *Aulacomnium palustre* and *Hylocomium splendens* implying the vegetation of the transition between poor-fen and raised bog.

Cloonmaul. The area of pools and hummocks is smaller than at Drumalough, is less diverse in species and is always more than 40 metres from the edge of the plantation. The undifferentiated wet bog is similar to Drumalough. Close to eastern corner of Coillte-owned cSAC there is a one hectare floating *Sphagnum* lawn with Hare's-tail Cottongrass on abandoned, shallow cut-over adjoining the mineral soil. The large area of cut-over bog to the west of the plantation is mostly unworked at present. It is divided into sections surrounded by high dividing banks. The vegetation is regenerating to some extent, but there is little opportunity to enhance the regeneration. The presence of buried forest stumps may prevent further exploitation. There is small area of sausage turf cutting.

Restoration Actions

At this site the main restoration measures undertaken was the clear-felling and removal of the mature conifer crop, felling to waste of younger conifers, wind-rowing of the remaining brash and blocking of drains with peat dams. Follow-up work included the control of the natural regeneration of conifer seedlings.

2. Methods

Prior to the start of restoration activities at the site, the habitats and vegetation occurring were surveyed and described (Conaghan, 2003). During the initial restoration work of 2005, permanent quadrats were established on each of the vegetation types within the project site.

During the field survey, particular attention was paid to the possible occurrence of plant and animal species which are considered to be rare in both a national and local context with particular emphasis on animal species listed in Annex II of the E.U. Habitats Directive and plant species listed in the Irish Red Data Book for vascular plants (Curtis and McGough, 1988), the 1999 Flora Protection Order and Annex II of the E.U. Habitats Directive.

3. Site Photographs

During the initial fieldwork a number of colour photographs of the site and vegetation encountered were taken with a digital camera and a selection of these are presented in this report. These include photographs taken by the Project Ecologist in order to illustrate the vegetation descriptions and changes in the habitats/vegetation present over time.

4. Vegetation of Project Site

Drumalough: The vegetation of the project site was previously dominated by tall of 25 year old Lodgepole Pine with either virtually no ground cover or, in places, sporadic cover of *Sphagnum palustre* and *S. capillifolium*. At one location these species form well-developed hummocks under the canopy. Within the largest section of plantation, two sections comprise very poorly growing conifers on a generally wet surface although somewhat dried out by numerous drains. The drains appear to slope southward towards the flush. A small isolated area of poor conifers with Ling Heather occurs in the south.

Cloonmaul Purple moor-grass occurs over much the 4.9 ha of conifer which lies within the SAC (extending into areas outside the SAC) indicating some circulating groundwater, or a flush. This is an important feature in the diversity of bog hydrology. In places the purple moor-grass is sparse, with little or no accompanying bog species, but in the south-west of the sub it is abundant and occurs with a luxurious growth of mosses such as *Aulacomnium palustre* and *Sphagnum palustre* accompanied by *S. papillosum*. Cranberry (*Vaccinium oxycoccos*) occurs also especially in the eastern end. The remainder of this section is similar to Drumalough, with little ground cover apart from sporadic *Sphagnum palustre* and *S. capillifolium*.

5. Changes in Overall Vegetation/Habitat Cover

Much of the site is now cleared of conifers and brash. The brash which remained after clear-felling has been wind-rowed to allow bog vegetation to re-colonise the exposed peat surface. With the removal of conifers and blocking of drains, there was a rise in the water-table, which allowed for the colonisation of *Sphagnum* mosses.

6. Vegetation Monitoring Quadrats

The vegetation changes which have taken place within the site over the period of the restoration project are shown by means of observed changes in permanent quadrats. Five permanent quadrats were installed on this site, which were described and photographed to monitor changes in vegetation over time. In order to ensure the future position of quadrats the corners have been marked with short stakes and an 8-figure GPS reading was also recorded. Each 10m x10m quadrat, was photographed annually and vegetation tables are presented below.

Quadrat 1: This quadrat is located towards the centre of the plantation on the south-east margin of Drumalough and occurred under closed canopy conifers with a ground cover containing some *Sphagnum recurvum*, but mainly consisted of pine needles. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather and Hare's-tail Cotton-grass cover increased along with *Sphagnum* cover. Over time, if conditions remain wet, *Sphagnum* cover will increase further and active peat formation will occur.

Drumalough Quadrat 1

Area: 10 x 10m

Location: 10m West W1

Grid Ref: M6632 8234

Altitude: 89m

Bog Type: Highbog

Ecotope: NA

Slope Flat

Aspect: NA

Landuse: Forestry

Management: Clearfell

Date	10/08/2005	02/08/2006	02/08/2007	14/08/2008
Firmness	Very Dry	Firm	Soft	Soft
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	0	0	0	0
Vegetation Cover %	14	35	75	45
Vegetation Height (cm)		1	10	50
Dwarf Shrub Cover %	1	0	10	20
Herb Cover %	0	5	10	25
Bryophyte Cover %	13	30	55	80
Sphagnum cover %	6	20	50	65
Open Water %		2	5	3
Brash cover %	30	20	20	20
Pine Needle cover %	50	40	5	5
Pine Needle Depth cm	15	5	1	1
Bare Peat %		5	5	2
Species number	5	8	12	19
<i>Pinus contorta</i>		5	1	1
<i>Betula pubescens</i>			1	1
<i>Rubus spp</i>				1
<i>Rumex acetosella</i>			1	1
<i>Holcus lanatus</i>				1
<i>Pteridium spp</i>				1
<i>Epiobium spp</i>				2
<i>Vaccinium myrtilus</i>	1			
<i>Calluna vulgaris</i>			10	20
<i>Eriophorium vaginatum</i>			7	15
<i>E. angustifolium</i>				3
<i>Rhyncospora alba</i>				1
<i>Campylopus atroverins</i>				3
<i>Hypnum jutlandicum</i>	5	10	5	10
<i>Polytricum commune</i>			1	2
<i>Dicranium spp</i>	1			
<i>Sphagnum recurvum</i>	5	5	10	10
<i>S cuspidatum</i>		2	5	5
<i>S. capillifolium</i>	1	5	20	20
<i>S. subnitens</i>		3	5	20
<i>S. magellanicum</i>		5	10	10

Drumalough Quadrat 1, 2005



Drumalough Quadrat 1, 2008



Quadrat 2: This quadrat is located at the northern margin of the south-east plantation and occurred with moribund trees and abundant bog vegetation of Ling Heather, Bog Asphodel, Hare's-tail Cotton-grass and numerous *Sphagnum* mosses. With the felling of the sparse conifers and blocking of drains, it can be seen that the *Sphagnum* cover reduced somewhat, but this will recover over time and active bog habitat will be established.

Drumalough Quadrat 2

Area: 10 x 10m

Location: 10m West W2

Grid Ref: m6234 8252

Altitude: 93m

Bog Type: Highbog

Ecotope: NA

Slope Flat

Aspect: NA

Landuse: Forestry

Management: Fell to Waste

Date	10/08/2005	02/08/2006	02/08/2007	14/08/2008
Firmness	Soft	Soft	Soft	V. Soft
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	5	0	0	0
Canopy Height	2	0	0	0
Vegetation Cover %	100	100	95	90
Vegetation Height (cm)		20	20	30
Dwarf Shrub Cover %	40	15	30	30
Herb Cover %	50	50	60	60
Bryophyte Cover %	75	55	50	55
Sphagnum cover %	65	45	40	40
Open Water %	0	0	0	5
Brash cover %	5	10	10	5
Pine Needle cover %	0	1	0	0
Pine Needle Depth cm		5	0	0
Bare Peat %		1	0	0
Species number	12	18	14	17
<i>Pinus contorta</i>	5	1		
<i>Molinia caerulea</i>		5		5
<i>Calluna vulgaris</i>	25	10	25	25
<i>Erica tetralix</i>	15	5	5	5
<i>Narthecium ossifragum</i>	40	30	30	30
<i>Carex panicea</i>		2	5	3
<i>Trichophorum caespitosum</i>				2
<i>Eriophorium vaginatum</i>	5	5	15	15
<i>E. angustifolium</i>		1	5	5
<i>Rhyncospora alba</i>	5	5	5	5
<i>Drosera rotundifolia</i>		2		1
<i>Cladonia portentosa</i>	20	20	20	20
<i>Hypnum jutlandicum</i>	10	10	5	10
<i>Polytricum commune</i>		1	5	5
<i>Sphagnum recurvum</i>	20	3		
<i>S. cuspidatum</i>	5		5	5
<i>S. capillifolium</i>	30	25	25	20
<i>S. tenellum</i>		1		
<i>S. subnitens</i>	10	5	5	10
<i>S. magellanicum</i>		10	5	5

Drumalough Quadrat 2, 2005



Drumalough Quadrat 2, 2008



Quadrat 3: This quadrat is located in the northern plantation on Drumalough and occurred under open canopy conifers with a ground cover containing *Sphagnum recurvum* and *S. capillifolium* along with pine needles. With the felling of conifers and blocking of drains, it can be seen that Ling Heather, Purple Moor-grass and Hare's-tail cotton-grass cover has increased along with *Sphagnum*. Over time, if conditions remain wet, *Sphagnum* cover will increase further and active raised bog habitat will occur.

Drumalough Quadrat 3

Area: 10 x 10m

Location: 10m East W10

Grid Ref: M6207 8308

Altitude: 94m

Bog Type: Highbog

Ecotope: NA

Slope: Flat

Aspect: NA

Landuse: Forestry

Management: Clearfell

Date	10/08/2005	02/08/2006	02/08/2007	14/08/2008
Firmness	Dry	Soft	Soft	Soft
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	50	0	0	0
Canopy Height	5	0	0	0
Vegetation Cover %	50	85	90	85
Vegetation Height (cm)		10	30	50
Dwarf Shrub Cover %	15	8	10	15
Herb Cover %		20	45	70
Bryophyte Cover %	50	85	70	80
Sphagnum cover %	45	65	70	70
Open Water %		5	5	5
Brash cover %	1	5	5	5
Pine Needle cover %	40	10	5	0
Pine Needle Depth cm	5	5	1	0
Bare Peat %		1	0	0
Species number	9	13	14	19
<i>Pinus contorta</i>	50	2	3	20
<i>Rubus spp</i>		1	1	1
<i>Juncus spp</i>			1	
<i>Molinia caerulea</i>		5	5	10
<i>Pteridium spp</i>				1
<i>Epiolobium spp</i>				1
<i>Vaccinium myrtillus</i>	2	1		2
<i>Calluna vulgaris</i>	1	2	5	10
<i>Erica tetralix</i>	10	5	5	3
<i>Eriophorium vaginatum</i>	1	10	25	25
<i>E. angustifolium</i>			5	5
<i>Drosera rotundifolia</i>				1
<i>Vaccinium oxycoccos</i>		3	5	5
<i>Cladonia portentosa</i>	1			
<i>Hypnum jutlandicum</i>	10	20		5
<i>Polytricum commune</i>				5
<i>Sphagnum recurvum</i>	5		5	5
<i>S cuspidatum</i>		2	5	5
<i>S. capillifolium</i>	40	40	40	30
<i>S. subnitens</i>		3	10	20
<i>S. magellanicum</i>		20	10	10

Drumalough Quadrat 3, 2005



Drumalough Quadrat 3, 2008



Quadrat 4: This quadrat is located towards the margin of the northern plantation at Drumalough and occurred under open canopy of conifers with a ground cover containing Ling Heather, Purple Moor-grass, Cotton-grasses and abundant *Sphagnum*. With the felling of the conifers and blocking of drains, it can be seen that *Sphagnum* cover decreased but this will recover over time. If conditions remain wet, *Sphagnum* cover will increase active bog habitat will be established.

Drumalough Quadrat 4

Area: 10 x 10m

Location: 10m West W9

Grid Ref: M6194 8294

Altitude: 85m

Bog Type: Highbog

Ecotope: NA

Slope Flat

Aspect: NA

Landuse: Forestry

Management: Fell to Waste

Date	10/08/2005	02/08/2006	02/08/2007	14/08/2008
Firmness	Soft	Soft	Dry	Firm
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes
Canopy Cover %	30	0	0	0
Canopy Height	2	0	0	0
Vegetation Cover %	100	75	80	75
Vegetation Height (cm)		20	50	50
Dwarf Shrub Cover %	60	35	45	35
Herb Cover %		15	35	40
Bryophyte Cover %	85	70	50	60
Sphagnum cover %	80	50	45	50
Open Water %		0	0	0
Brash cover %		20	20	20
Pine Needle cover %		5	5	5
Pine Needle Depth cm		5	1	1
Bare Peat %		2	5	0
Species number	11	12	12	12
<i>Pinus contorta</i>	30	1	2	1
<i>Molinia caerulea</i>	10	5	5	10
<i>Calluna vulgaris</i>	50	30	40	30
<i>Erica tetralix</i>	10	5	5	5
<i>Carex panicea</i>	1		5	
<i>Eriophorium vaginatum</i>	10	5	20	20
<i>E. angustifolium</i>		2	5	10
<i>D. anglica</i>		1		
<i>Cladonia portentosa</i>	10	10	20	20
<i>Hypnum jutlandicum</i>	5	20	5	10
<i>Sphagnum recurvum</i>	5		5	
<i>S. capillifolium</i>	60	30	30	20
<i>S. papillosum</i>				5
<i>S. subnitens</i>	10	10	10	20
<i>S. magellanicum</i>		10		5

Drumalough Quadrat 4, 2005



Drumalough Quadrat 4, 2008



Quadrat 5: This quadrat is located towards the margin of the conifer plantation in the western section of raised bog and occurred under closed canopy conifers with a ground cover containing bog vegetation including abundant *Sphagnum*. With the felling of the conifers and blocking of drains, it can be seen that the bog vegetation remains but *Sphagnum* cover decreased. *Sphagnum* cover will recover over time and if conditions remain wet, active raised bog habitat will be established.

Drumalough Quadrat 5

Area: 10 x 10m

Location: 10m East W4

Grid Ref: M5919 8416

Altitude: 79m

Bog Type: Cutaway

Ecotope: NA

Slope: Flat

Aspect: NA

Landuse: Forestry

Management: Fell to Waste

Date	10/08/2005	02/08/2006	02/08/2007	14/08/2008
Firmness	Soft	Wet	Dry	Soft
Drains	Yes	Yes	Yes	Yes
Canopy Cover %	80	0	0	0
Canopy Height	10	0	0	0
Vegetation Cover %	100	45	45	50
Vegetation Height (cm)		20	10	30
Dwarf Shrub Cover %	35	25	25	25
Herb Cover %	10	20	20	25
Bryophyte Cover %	90	45	35	55
Sphagnum cover %	75	45	35	50
Open Water %		0	0	10
Brash cover %		70	55	10
Pine Needle cover %	50	5	10	20
Pine Needle Depth cm	1	5	5	5
Bare Peat %		0	0	5
Species number	15		10	14
<i>Pinus contorta</i>	80		2	1
<i>Molinia caerulea</i>	5	5	10	10
<i>Pteridium</i> spp	5			3
<i>Epiolobium</i> spp				2
<i>Vaccinium myrtillus</i>	10	10	10	10
<i>Calluna vulgaris</i>	15	10	10	10
<i>Erica tetralix</i>	10	5	5	5
<i>Narthecium ossifragum</i>	10	5	10	
<i>Eriophorium vaginatum</i>	10		5	10
<i>Drosera rotundifolia</i>	10	2		
<i>Cladonia portentosa</i>	20	10	10	10
<i>Hypnum jutlandicum</i>				5
<i>S. capillifolium</i>	50	30	30	25
<i>S. papillosum</i>				5
<i>S. subnitens</i>	20	5		10
<i>S. magellanicum</i>		5	5	10

Drumalough Quadrat 5, 2005



Drumalough Quadrat 5, 2008



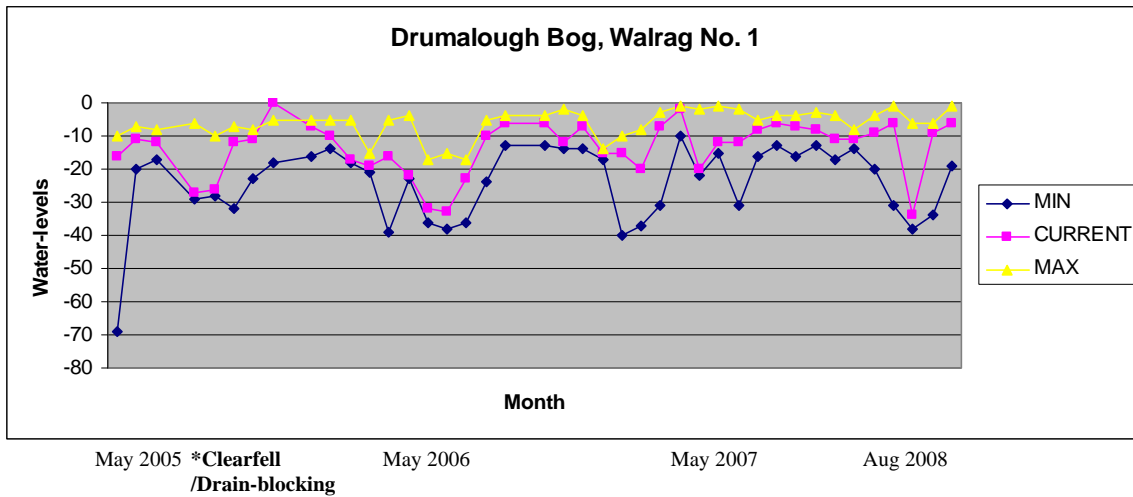
7. Changes in Water-levels

Prior to restoration, Walrags were installed in the conifer plantation to record any changes in water-levels, due to tree removal and drain blocking. Water-levels were found to be up to **40cm** below the surface. With the removal of conifers and drain-blocking, there was a significant rise in the water-table within the project site and the water-table remains close to the bog surface throughout most of the year.

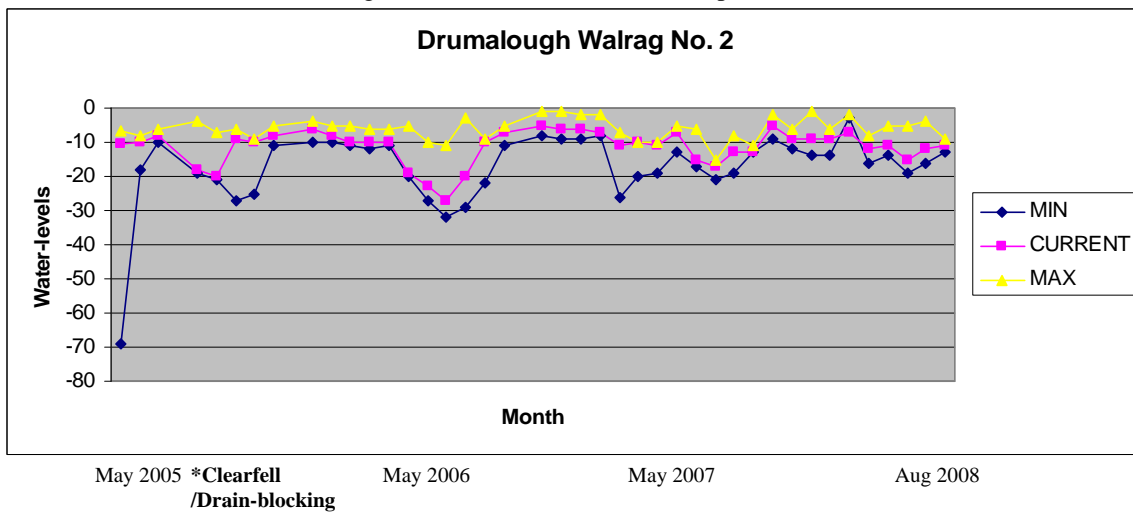
8. Hydrological Monitoring (Walrag) Graphs

During the clear-felling operation, eight Walrags were installed on this site to record the changes in water-levels. The rise in water-levels is clearly seen in the following graphs.

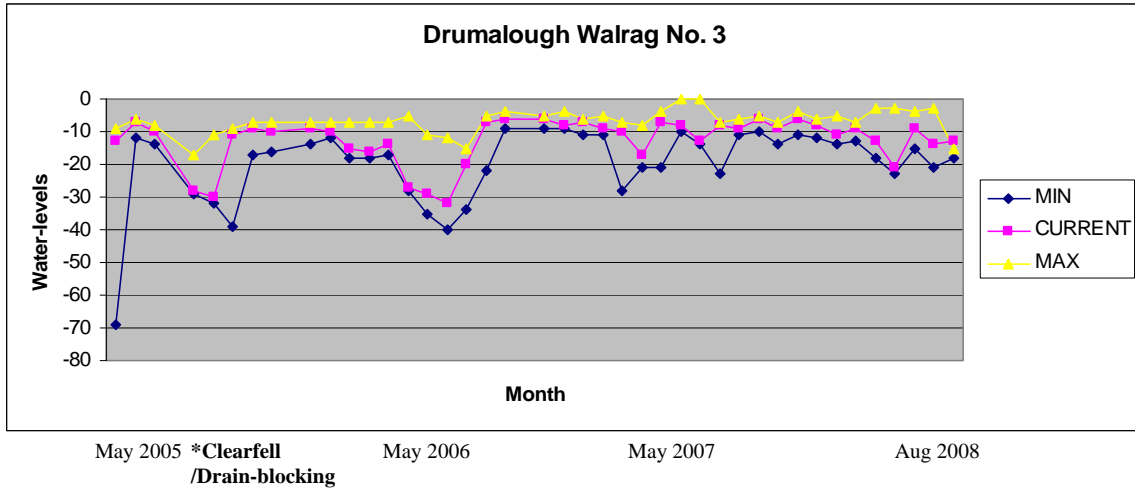
Drumalough Bog Walrag 1: Closed Canopy Conifer Plantation on High Bog. (Water-levels decline in summer months, with little change post restoration*)



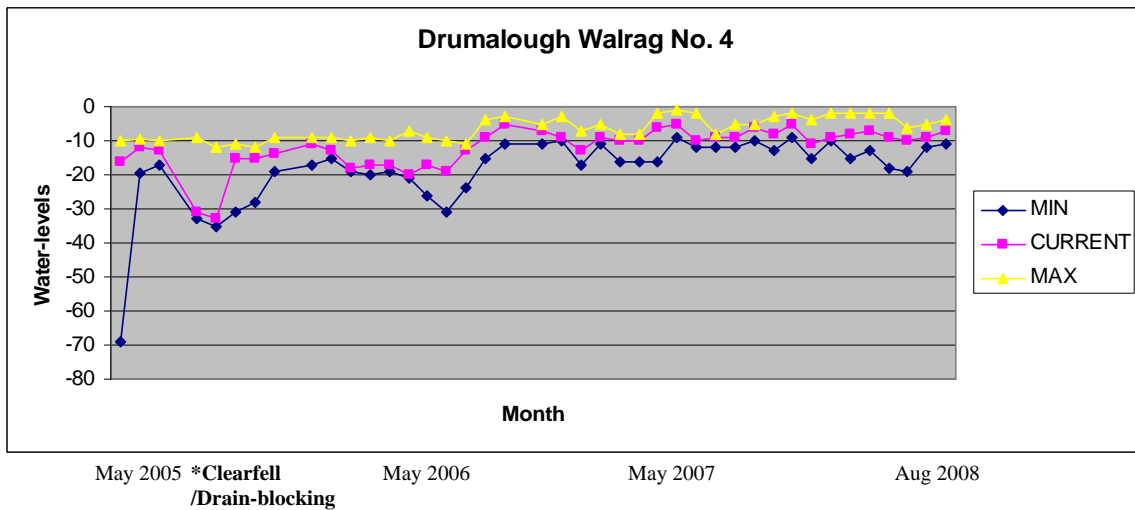
Drumalough Bog Walrag 2: Open Canopy Conifer Plantation on High Bog. (Water-levels decline in summer months, before tree-felling. Water-levels have been raised post restoration*)



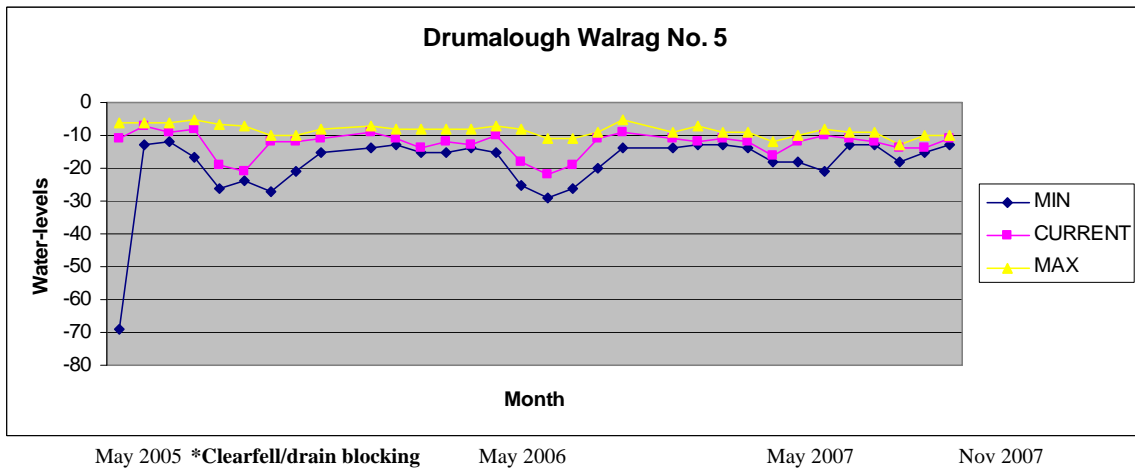
Drumalough Bog Walrag 3: Open Canopy Conifer Plantation on High Bog. (Decline in water-levels in summer months before tree-felling. Water-levels have been raised post restoration*)



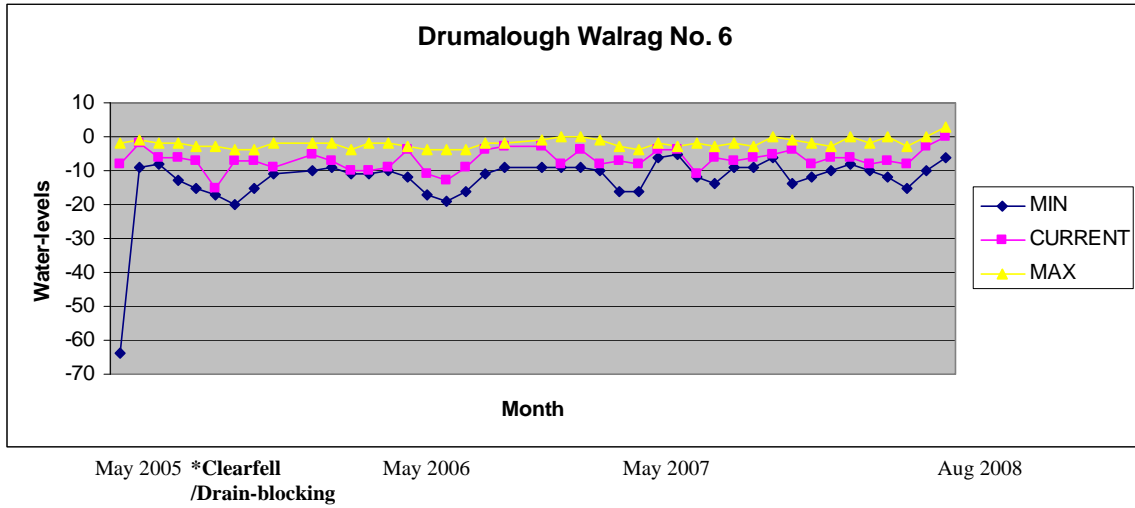
Drumalough Bog Walrag 4: Unplanted Cutover Bog. (Decline in water-levels during summer months. Water-levels have risen post restoration* on adjacent conifer plantations)



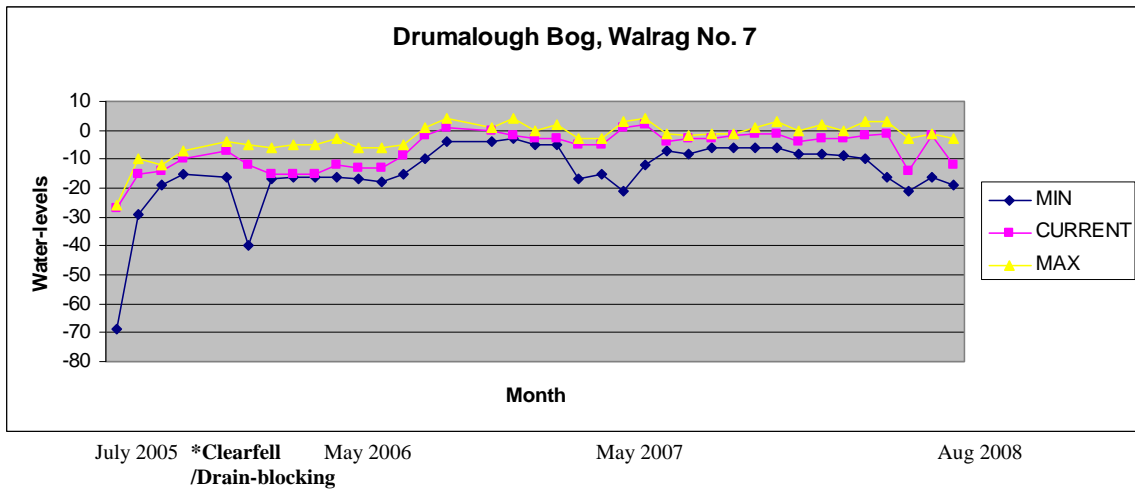
Drumalough Bog Walrag 5: Unplanted Cutover Bog. (Decline in water-levels during summer months, has decreased post restoration* on adjacent conifer plantations, this Walrag was removed in Dec 2007)



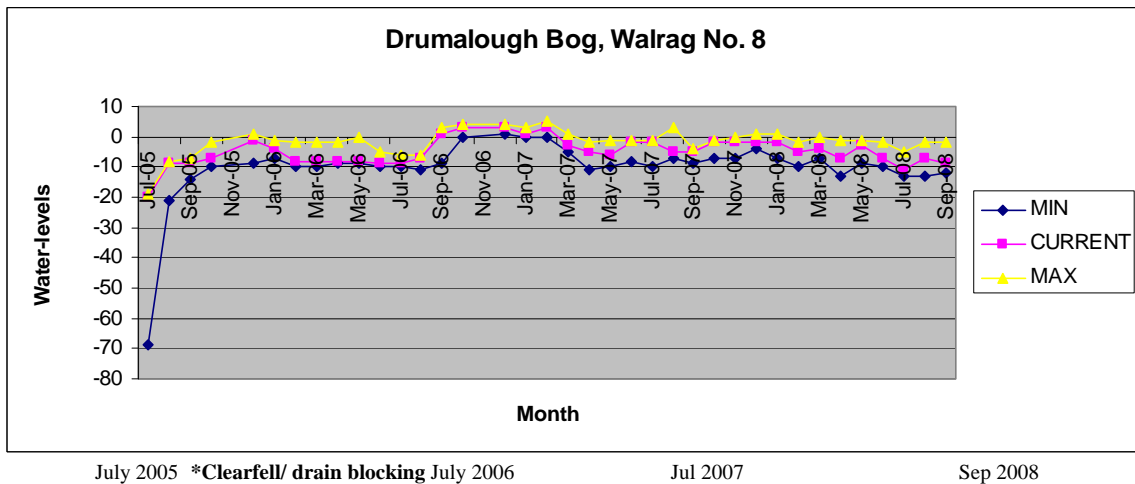
Drumalough Bog Walrag 6: Open Canopy Conifer Plantation on High Bog. (Decline in water-levels in summer months before tree-felling. Water-levels have been raised slightly post restoration*)



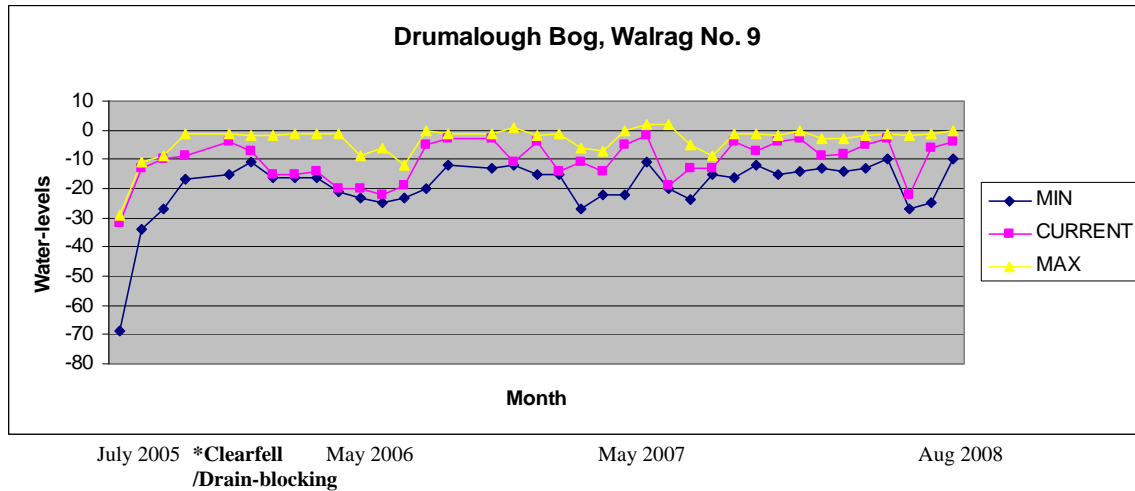
Drumalough Bog Walrag 7: Closed Canopy Conifer Plantation on High Bog. (Water-levels decline in summer months before tree-felling. Water-levels have been raised post restoration*)



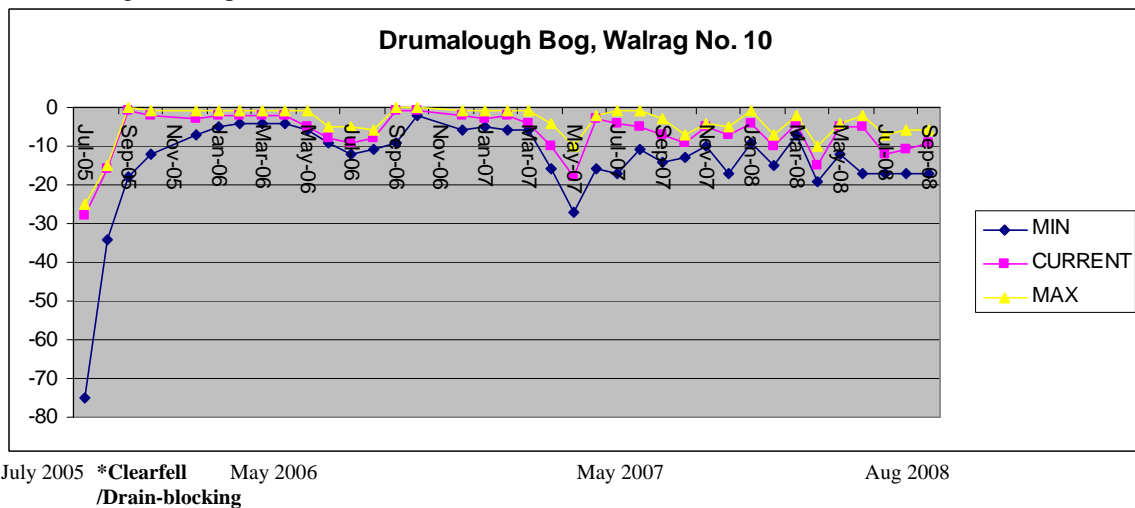
Drumalough Bog Walrag 8: Clearfelled Conifer Plantation on High Bog. (Water-levels remain within 10cm of bog surface post restoration*)



Drumalough Bog Walrag 9: Open Canopy Conifer Plantation on High Bog. (Decline in water-levels in summer months before tree-felling. Water-levels have been raised slightly post restoration*).



Drumalough Bog Walrag 10: Clearfelled Conifer Plantation on High Bog. (Water-levels remain within 20cm of bog surface post restoration*).



9. Conclusion

There are very good prospects for the protection and restoration of good quality raised bog habitats in both the Drumalough and Cloonmaul sections of this cSAC. A section outside the cSAC should be included in the management plan.

10. References

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