

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

**A REPORT ON THE RESTORATION OF PROJECT SITE No. 4**

**KILLSALLAGH BOG, Co. GALWAY**



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## Project Site No. 4 - Kilsallagh Bog, Co. Galway

### 1. Introduction

<b>Grid Reference</b> IM6696 6819	<b>Elevation (m)</b> 85	<b>Bedrock Geology</b> <b>Limestone</b>
<b>SAC Name and Number</b> Kilsallagh Bog cSAC (285)	<b>Project Site Area (ha)</b> 29.7	<b>Main Restoration Methods</b> Fell to Waste conifer crop Block drains with plastic dams Control natural regeneration
<b>SAC Area (ha)</b> 280		
<b>Area of Conifer Cover (ha)</b> 10.8	<b>Area of Open Bog (ha)</b> 18.9	<b>Area of Birch Woodland (ha)</b> 0
<b>Noteworthy habitats/plant/animal species present</b> Red Grouse a scarce and declining species in Ireland breeds on the adjoining open bog.		

### General site description

Kilsallagh bog is a large raised bog with a largely intact dome set in a peat basin, almost completely surrounded by mineral soil. The site is located 5km south-west of Ballymoe, and 7km north-east of Glenamaddy Co. Galway. The centre of the high bog contains active raised bog habitat of excellent quality, with a hummock and pool system grading into an extensive area of Bog Moss (notably *Sphagnum papillosum* and *S. magellanicum*) lawns, which are actively growing. This central part of the high bog is extremely wet and quaking. The high bog grades down on the north-east slope into an unusual flush consisting of Carnation Sedge (*Carex panicea*), Bog Cottons (*Eriophorum* spp.) with frequent tufts of Deergrass (*Trichophorum caespitosum*). This vegetation has 100% cover of Bog Mosses. A large part of the intact dome is of medium quality, capable of good recovery were it not for damage from intermittent fire (NPWS, 1997).

Most of the boundary is on or close to the mineral soil and so the site encloses most of the original peat basin. Damage has occurred in the form of a 12ha conifer plantation on the dome and more recently from 20ha of drains, which encroach onto the good quality high bog. Burning also threatens the site, causing drying out of the bog surface (NPWS, 1997).

Although the margins of the bog have been subject to rather intensive peat cutting in the past, which has resulted in the drying out of the adjacent high bog, most the high bog area is now owned by National Parks and Wildlife, which augurs well for its future protection. In the south of the site there are two substantial areas of drains on the high bog surface (not within areas owned by Coillte) while in the north there is 10.5 hectares of partially failed conifer plantation. In spite of this afforestation, the peat surface of this plantation is still remarkably wet with a high *Sphagnum* moss cover still evident in places (Conaghan, 2003).

### **Project Site Description (Pre-restoration)**

The project area consists of 10.8 hectares of failed conifer plantation, planted on high bog along with 18.9ha of open bog. The conifers consist largely of Lodgepole Pine (*Pinus contorta*). Although the conifers formed a closed canopy in places, bog vegetation remained on the wet bog surface.

### **Description of bog vegetation adjoining planted areas**

At Kilsallagh the plantation area is surrounded by intact high bog on all sides. The intact bog to the north is dominated by species such as Hare's-tail Cottongrass (*Eriophorum vaginatum*), Deergrass, Carnation Sedge and Bog Asphodel (*Narthecium ossifragum*). The dominance of these species and the general lack of pools in this area indicate that the area is being affected by drying-out and/or burning. This open bog area is being encroached upon by peat-cutting, especially from the north-east and is owned by Coillte. To the south there is an extensive area of wet high bog with small pool areas and a high *Sphagnum* moss cover (Conaghan, 2003).

### **Restoration Actions**

At this site the main restoration measures undertaken were the felling to waste and windrowing of the conifer crop and blocking of drains with plastic 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 was 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 international 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 a selection of ground 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**

The site was surveyed in 2003, prior to restoration, which found that the planted bog area was dominated by a mosaic of stunted and relatively well-grown Lodgepole Pine which was 25 years old. In areas with tall (5 to 8 m) pine there was little bog vegetation present and the ground flora was dominated by a thick layer of Lodgepole Pine needles with the mosses *Hypnum jutlandicum* and *Sphagnum recurvum*. However in areas dominated by stunted pine (typically < 2 metres tall) well-developed raised bog vegetation was still present. Ling Heather (*Calluna vulgaris*) was generally dominant but there was also a good cover of *Sphagnum* species (mostly *S. papillosum* and *S. capillifolium*) and lichens along with vascular species such as Cranberry (*Vaccinium oxycoccos*), Bog-rosemary (*Andromeda polifolia*), Cross-leaved Heath (*Erica tetralix*), Hare's-tail Cottongrass and Bog Asphodel also present (Conaghan, 2003).

#### **5. Changes in Overall Vegetation/Habitat Cover**

Much of the site is now cleared of conifers. The brash which remained after felling to waste was wind-rowed to allow bog vegetation to re-colonise exposed peat surface. With the felling 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 on the northern margin of Kilsallagh Bog and occurred on open high bog with vegetation containing Ling Heather, Cross-leaved Heath, Bog Asphodel, Carnation Sedge and bog Bean. There are a number of pools present with *Sphagnum* moss. With the blocking of drains, *Sphagnum* cover will increase and over time, this wet bog margin will develop into active raised bog.

### Kilsallagh Quadrat 1

Area: 10 x 10m

Bog Type: High Bog

Landuse: Unplanted

Location: 30m South W7

Ecotope: Sub-marginal

Management: Non-intervention

Grid Ref: M6715 6769

Slope: Flat

Altitude: 78m

Aspect: NA

Date	22/08/2005	31/08/2006	23/08/2007	08/08/2008
Firmness	V soft	V Soft	Very soft	Very soft
Drains	No	No	No	No
Canopy Cover %	0	0	0	0
Canopy Height	0	0	0	0
Vegetation Cover %	100	95	95	95
Vegetation Height (cm)	20	20	20	20
Dwarf Shrub Cover %	15	20	20	20
Herb Cover %	65	75	75	75
Bryophyte Cover %	42	45	30	35
Sphagnum cover %	40	40	30	30
Open Water %	10	5	10	5
Brash cover %	0	0	0	0
Pine Needle cover %	0	0	0	0
Pine Needle Depth cm	0	0	0	0
Bare Peat %	0	0	0	0
Species number	16	15	15	19
<i>Pinus contorta</i>			1	1
<i>Calluna vulgaris</i>	5	10	10	10
<i>Erica tetralix</i>	10	10	10	10
<i>Menyanthes trifoliata</i>	5	5	5	5
<i>Nartheicum ossifragum</i>	30	40	35	20
<i>Carex panicea</i>	20	20	20	25
<i>Trichophorum caespitosum</i>	5	5	10	5
<i>Eriophorium vaginatum</i>				5
<i>E. angustifolium</i>				5
<i>Rhyncospora alba</i>	2	1	5	5
<i>Andromeda polifolia</i>	5	3	1	1
<i>Drosera rotundifolia</i>	3	1	1	2
<i>D. anglica</i>				2
<i>Cladonia portentosa</i>	30	30	30	30
<i>C. introflexus</i>	2			5
<i>S cuspidatum</i>	5	5	5	5
<i>S. auriculatum</i>	5			
<i>S. capillifolium</i>	5	20	10	10
<i>S. subnitens</i>	10	10	5	5
<i>S. magellanicum</i>	15	10	10	10
Algae spp.				1

**Kilsallagh Quadrat 1, 2005**



**Kilsallagh Quadrat 1, 2008**



**Quadrat 2:** This quadrat is located in the centre of the plantation on Kilsallagh Bog and occurred within a moribund conifer plantation with a ground cover containing Hare's-tail Cotton-grass, Bog-rosemary and abundant Cranberry. There is also an abundant cover of *Sphagnum* moss. Only three year were monitored as felling occurred in August 2006. With the felling to waste of the conifers, it can be seen that bog vegetation still dominates and over time, this wet bog habitat will develop into **active raised bog.**

### **Kilsallagh Quadrat 2**

**Area:** 10 x 10m

**Location:** 10m West W1/ At W1

**Grid Ref:** M6727 6775

**Altitude:** 86m

**Bog Type:** High Bog

**Ecotope:** NA

**Slope:** Flat

**Aspect:** NA

**Landuse:** Forestry

**Management:** Fell to Waste

Date	22/08/2005	23/08/2007	08/08/2008
Firmness	Soft	Soft	V. Soft
Drains	Yes	Yes	Yes
Canopy Cover %	80	0	0
Canopy Height	10	0	0
Vegetation Cover %	90	100	80
Vegetation Height (cm)	50	50	50
Dwarf Shrub Cover %	5	10	20
Herb Cover %	40	50	60
Bryophyte Cover %	85	70	75
Sphagnum cover %	80	60	65
Open Water %		5	0
Brash cover %	1	30	20
Pine Needle cover %	10	0	0
Pine Needle Depth cm	5	0	0
Bare Peat %		0	0
Species number	13	12	19
<i>Pinus contorta</i>			2
<i>Juncus effusus</i>			5
<i>Vaccinium myrtillus</i>		5	
<i>Calluna vulgaris</i>		5	10
<i>Erica tetralix</i>			10
<i>Erica cineria</i>	5		
<i>Narthecium ossifragum</i>		5	5
<i>Eriophorium vaginatum</i>	40	40	35
<i>E. angustifolium</i>	5		5
<i>Andromeda polifolia</i>	5	1	2
<i>Drosera rotundifolia</i>		1	3
<i>Vaccinium oxycoccus</i>	15	5	5
<i>Cladonia portentosa</i>	15	25	20
<i>Hypnum jutlandicum</i>		10	5
<i>Polytricum commune</i>	5		5
<i>Sphagnum recurvum</i>	20		
<i>S. cuspidatum</i>	10	5	5
<i>S. capillifolium</i>	10	25	15
<i>S. papillosum</i>	10		5
<i>S. tenellum</i>			5
<i>S. subnitens</i>	10	10	15
<i>S. magellanicum</i>	20	20	20



**Kilsallagh Quadrat 2, 2005**



**Kilsallagh Quadrat 2, 2008**



**Quadrat 3:** This quadrat is located on the southern margin of the plantation on Kilsallagh Bog and occurred within a moribund conifer plantation with a ground cover containing Ling Heather, Cross-leaved Heath, Hare's-tail Cottongrass and White-beaked Sedge. There is also abundant *Sphagnum* moss cover. With the felling to waste of the conifers, it can be seen that bog vegetation still dominates and over time, this wet bog habitat will develop into **active raised bog**.

### **Kilsallagh Quadrat 3**

**Area:** 10 x 10m

**Location:** 50m East W2

**Grid Ref:** M6730 6746

**Altitude:** 79m

**Bog Type:** High Bog

**Ecotope:** NA

**Slope:** Flat

**Aspect:** NA

**Landuse:** Forestry

**Management:** Fell to Waste

Date	22/08/2005	31/08/2006	23/08/2007	08/08/2008
Firmness	Very soft	V Soft	Very soft	V.soft/quaking
Drains	Yes	Yes	Yes	Yes
Canopy Cover %	10	0	0	0
Canopy Height	2	0	0	0
Vegetation Cover %	100	100	100	95
Vegetation Height (cm)	30	30	30	50
Dwarf Shrub Cover %	40	30	40	40
Herb Cover %	60	50	50	55
Bryophyte Cover %	90	80	70	80
Sphagnum cover %	85	75	70	75
Open Water %	0	0	5	5
Brash cover %	0	15	10	5
Pine Needle cover %	0	0	0	0
Pine Needle Depth cm	0	0	0	0
Bare Peat %	0	0	0	0
Species number	16	19	14	19
<i>Pinus contorta</i>	10	1	1	1
<i>Calluna vulgaris</i>	30	20	30	30
<i>Erica tetralix</i>	10	10	10	10
<i>Menyanthes trifoliata</i>	5	5	5	5
<i>Narthecium ossifragum</i>	10	5	10	5
<i>Carex panicea</i>		5	5	10
<i>Eriophorium vaginatum</i>	20	20	20	20
<i>E. angustifolium</i>	10			5
<i>Rhyncospora alba</i>	15	10	10	6
<i>Andromeda polifolia</i>		1		
<i>Drosera rotundifolia</i>	5	3	1	3
<i>Cladonia portentosa</i>	40	40	30	35
<i>Hypnum jutlandicum</i>	5	5		5
<i>Sphagnum recurvum</i>		10		
<i>S. cuspidatum</i>	5	5	10	5
<i>S. auriculatum</i>	5			
<i>S. capillifolium</i>	10	15	20	10
<i>S. papillosum</i>		5		10
<i>S. tenellum</i>		5		5
<i>S. subnitens</i>	30	10	10	10
<i>S. magellanicum</i>	30	25	30	30

**Kilsallagh Quadrat 3, 2005**



**Kilsallagh Quadrat 3, 2008**





**Quadrat 4:** This quadrat is located on the north-east margin of the plantation on Kilsallagh Bog and occurred within closed canopy conifer plantation *Sphagnum recurvum* moss, but is mainly dominated by pine needles. Only three year were monitored as felling occurred in August 2006. With the felling to waste of the conifers, it can be seen that Hare's-tail Cotton-grass and *Sphagnum* moss cover increased. Over time, this wet bog habitat will develop into **active raised bog**.

#### **Kilsallagh Quadrat 4**

**Area:** 10 x 10m

**Location:** 20m North W3/ At W3 **Grid Ref:** M6712 6747

**Altitude:** 78m

**Bog Type:** High Bog

**Ecotope:** NA

**Slope:** Flat

**Aspect:** NA

**Landuse:** Forestry

**Management:** Fell to Waste

Date	22/08/2005	23/08/2007	08/08/2008
Firmness	Soft	Soft	Soft
Drains	Yes	Yes	Yes
Canopy Cover %	90	0	0
Canopy Height	10	0	0
Vegetation Cover %	35	40	25
Vegetation Height (cm)	5	5	20
Dwarf Shrub Cover %	1	0	10
Herb Cover %	1	5	15
Bryophyte Cover %	33	40	50
Sphagnum cover %	30	30	35
Open Water %	0	0	0
Brash cover %	0	50	60
Pine Needle cover %	65	30	20
Pine Needle Depth cm	5	5	5
Bare Peat %	0	0	0
Species number	5	6	16
<i>Pinus contorta</i>	90	1	2
<i>Salix</i> spp.			1
<i>Rumex acetosella</i>			1
<i>Pteridium</i> spp			1
<i>Vaccinium myrtillus</i>			2
<i>Calluna vulgaris</i>	1		2
<i>Erica tetralix</i>			5
<i>Erica cineria</i>			
<i>Eriophorium vaginatum</i>		5	10
<i>E. angustifolium</i>			1
<i>Andromeda polifolia</i>			2
<i>Drosera rotundifolia</i>			1
<i>Hypnum jutlandicum</i>	3	10	10
<i>Polytricum commune</i>			5
<i>Sphagnum recurvum</i>	30	5	5
<i>S. capillifolium</i>		10	15
<i>S. subnitens</i>		10	10
<i>S. magellanicum</i>		5	5

**Kilsallagh Quadrat 4, 2005**



**Kilsallagh Quadrat 4, 2008**



**Quadrat 5:** This quadrat is located on the south-western margin of the plantation on Kilsallagh Bog and occurred within closed canopy conifer plantation with a ground cover containing Hare's-tail Cottongrass, Bog Asphodel and abundant *Cladonia* lichen and *Sphagnum* moss. Only three years were monitored as tree-felling occurred in August 2006. With the felling to waste of the conifers, it can be seen that raised bog vegetation dominates. Over time, this wet bog habitat will develop into **active raised bog**.

### **Kilsallagh Quadrat 5**

**Area:** 10 x 10m

**Location:** 30m West W4/ At W4

**Grid Ref:** M6741 6768

**Altitude:** 80m

**Bog Type:** High Bog

**Ecotope:** NA

**Slope:** Flat

**Aspect:** NA

**Landuse:** Forestry

**Management:** Fell to Waste

Date	22/08/2005	23/08/2007	08/08/2008
Firmness	Soft	Soft	V. Soft
Drains	Yes	Yes	Yes
Canopy Cover %	60	0	0
Canopy Height	10	0	0
Vegetation Cover %	100	25	50
Vegetation Height (cm)	20	20	30
Dwarf Shrub Cover %	20	10	10
Herb Cover %	65	15	40
Bryophyte Cover %	90	80	80
Sphagnum cover %	70	65	65
Open Water %	0	0	0
Brash cover %	0	30	25
Pine Needle cover %	0	10	5
Pine Needle Depth cm	0	5	1
Bare Peat %	0	0	0
Species number	14	11	14
<i>Pinus contorta</i>	60	1	8
<i>Epiolobium spp</i>			5
<i>Calluna vulgaris</i>	15		
<i>Erica tetralix</i>	5	10	10
<i>Narthecium ossifragum</i>	20		
<i>Eriophorium vaginatum</i>	20	10	15
<i>E. angustifolium</i>		5	10
<i>Andromeda polifolia</i>	3		2
<i>Cladonia portentosa</i>	40	10	10
<i>Hypnum jutlandicum</i>	10	10	10
<i>Polytricum commune</i>	5	5	5
<i>Sphagnum recurvum</i>		5	5
<i>S. capillifolium</i>	20	30	25
<i>S. tenellum</i>			5
<i>S. subnitens</i>	20	10	10
<i>S. magellanicum</i>	30	20	20



**Kilsallagh Quadrat 5, 2005**



**Kilsallagh Quadrat 5, 2008**



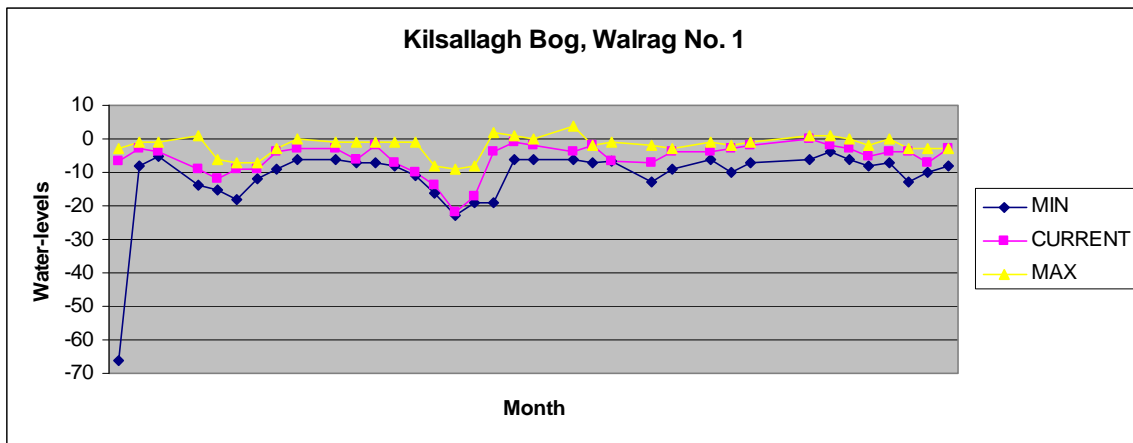
## 7. Changes in Water-levels

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 rise in the water-table in the plantation on the high bog project and the water-table remains close to the bog surface throughout most of the year.

## 8. Hydrological Monitoring (Walrag) Graphs

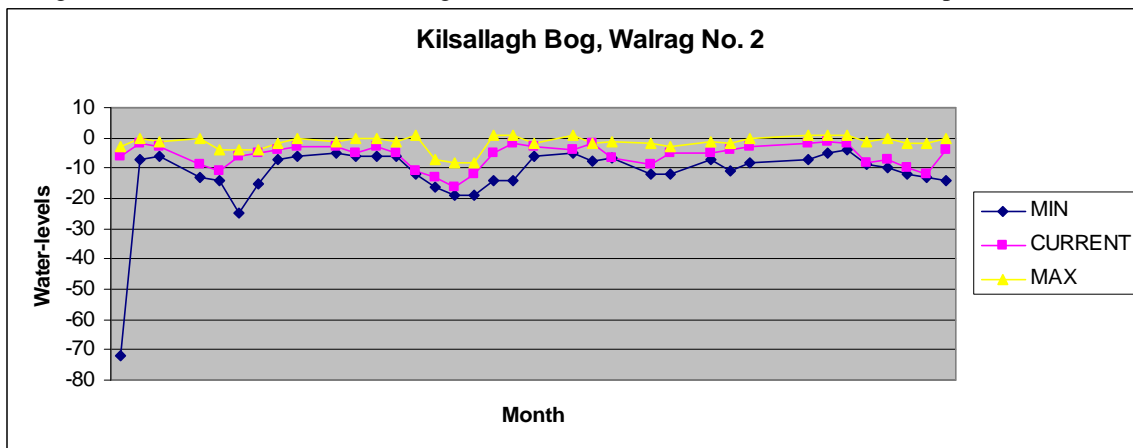
During the clear-felling operation, eight Walrags were installed on this site to record the changes in water-levels. The rise in water-levels is clearly seen in the following graphs.

**Kilsallagh Bog Walrag 1: Young Conifer Plantation on High Bog.** (Water-levels high throughout year, slight decline in summer before tree-felling. Water-levels remain within 10cm of surface post restoration\*)



(Installed) May 2005    **Clearfell \***    May 2006    May 2007    **Drain-blocking \***    Aug 2008

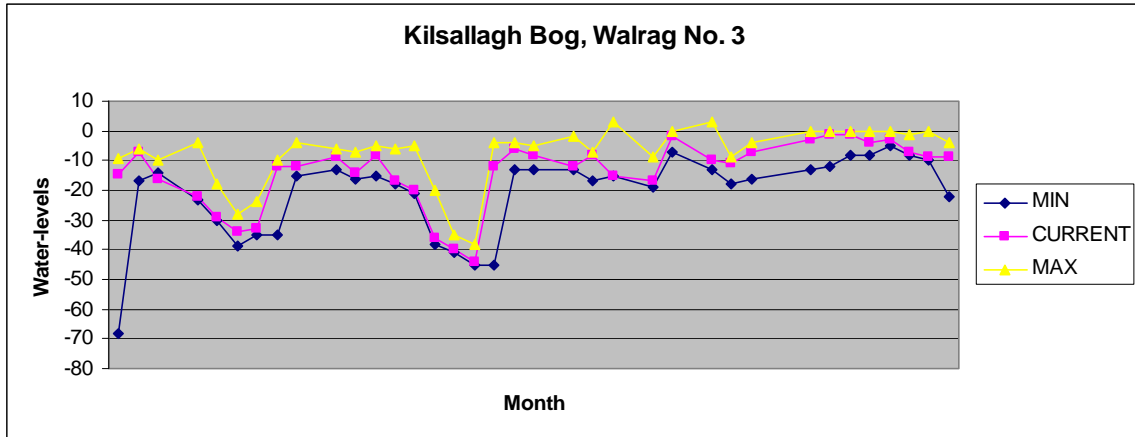
**Kilsallagh Bog Walrag 2: Conifer Plantation Margin on High Bog.** (Slight decline in water-levels during summer months, before tree-felling. Water-levels remain within 10cm of surface post restoration \*)



(Installed) May 2005    **Clearfell \***    May 2006    May 2007    **Drain-blocking \***    Aug 2008

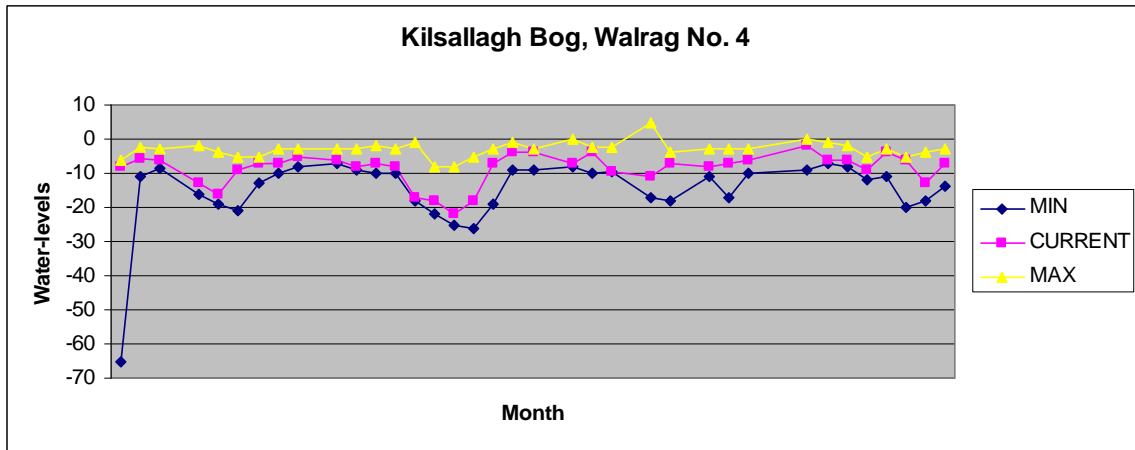


**Kilsallagh Bog Walrag 3: Closed Canopy Conifer Plantation on High Bog.** (Decline in water-levels in summer months before tree-felling. Distinct rise in water-levels post restoration\*)



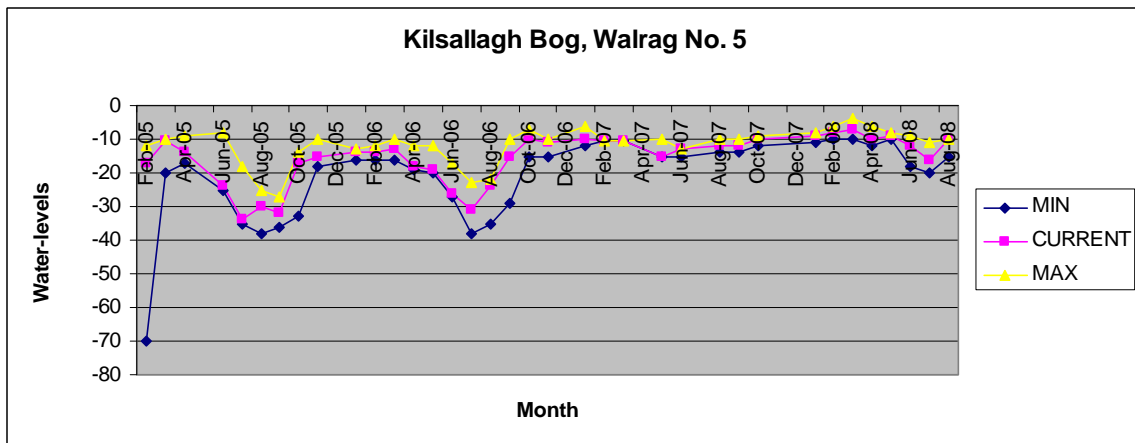
(Installed) May 2005    **Clearfell \***    May 2006    May 2007    **Drain-blocking \***    Aug 2008

**Kilsallagh Bog Walrag 4: Open High Bog at Plantation Margin.** (Decline in water-levels during summer months less distinct post restoration\*)



(Installed) May 2005    **Clearfell \***    May 2006    May 2007    **Drain-blocking \***    Aug 2008

**Kilsallagh Bog Walrag 5: Closed Canopy Conifer Plantation on High Bog.** (Distinct decline in water-levels in summer months before tree-felling. Water-levels remain high in summer post restoration\*)



(Installed) May 2005    **Clearfell \***    May 2006    May 2007    **Drain-blocking \***    Aug 2008



## **9. Conclusion**

This is a high quality raised bog site and the removal of the plantation from the high bog will have a positive effect on the hydrology of the adjoining high bog and may lead to the establishment of active raised bog habitat within the project site.

## **10. References**

- Brooks, S. (2005). *Assessment of Project Sites, Restoring Raised Bog in Ireland*. Coillte LIFE Nature Project. Peatland Consulting
- Conaghan, J. (2003). *Raised Bog Ecological Report*. Coillte
- Curtis, T.G.F. & McGough, H.N. (1988). *The Irish Red Data Book. 1: Vascular Plants*. The Stationery Office, Dublin.
- NPWS Site Synopsis