

Appendix 6-7

Marsh Fritillary Report



Marsh fritillary Habitat Condition Assessment

Carrownagowan Wind Farm



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1 INTRODUCTION

Marsh fritillary (*Euphydryas aurinia*) is the only Irish butterfly species listed under Annex II of the EU Habitats Directive¹ and in the latest Red List assessment of Irish butterflies (Regan *et al.*, 2010) the species was assessed as Vulnerable. It is, therefore, a species of conservation significance, whose conservation status is threatened, of which due consideration must be taken when developments, particularly those of scale, are proposed. Distribution mapping, in Heath *et al.* (1984), indicates that the species' distribution includes Hectad R67 which encompasses the Carrownagowan Wind Farm site and the species is also recorded² in several hectads that encompass the wider geographical area extending away from the site.

In light of the proximity of these records and on the basis of the precautionary principle it was decided to determine whether suitable habitat was available within Carrownagowan Wind Farm. To that end a Habitat Condition Survey (HCS) was conducted on September 13th, 2018, during the period when devil's-bit scabious (*Succisa pratensis*), the main food plant of the species' larval stage, is most apparent. In the event that the food plant was encountered, a larval web survey would be carried out at the same time.

Because this species has a meta-population structure i.e. a central population with outlying colonies that are lost during periodic declines, the central concern of this survey was to determine not only if the species is currently present but also and more importantly whether suitable habitat is available. If suitable habitat is present, but the species is not, recommendations designed to conserve or improve the habitat so that it can be reoccupied during periods of expansion.

2 DESCRIPTION OF THE SPECIES

2.1 LIFE CYCLE

The adult butterflies fly from May to June and the mature females lay their eggs on the underside of the leaves of the food plant (Devil's bit scabious) in single large batches of up to 350 eggs. The larvae hatch roughly 30 days later in early to mid-June and, as soon as they hatch, they spin a web close to the ground around the basal leaves of the devil's bit scabious plant. They live in large groups creating small areas of dense webs feeding mainly on the undersides of the leaves to which the web is attached. During the larval stage they cluster together and bask in the sunlight to increase their body temperature to digest their food. By late September these dense webs and the black coloured larvae are very conspicuous and can be seen attached to basal leaves and, in some circumstances, to other surrounding vegetation as well.

The larvae stay together in colonies until March when they disperse and pupate and they emerge as adults in early April to May on the leaves or twigs of the scabious plant. The emerging adults then start the lifecycle again and survive for about two to three weeks.

¹ Species whose conservation requires the designation of special areas of conservation

² <https://maps.biodiversityireland.ie/Map>

2.2 HABITAT REQUIREMENTS

Although it is widely recorded in Ireland, the species generally exists in extremely localised colonies where it is only found in areas of low intensity land use, typically where grazing by cattle at low stock density occurs, or areas not mown too short or too frequently. The species requires a low (ideally 25cm or less), open sward with at least a 25% density of devil's-bit scabious (Harding, 2009). Because the feeding larvae will abandon the initial plant once it has been consumed females never lay on isolated plants. There must be adjoining plants to which the feeding larvae can move quickly and easily. The distribution of the food plant, and therefore the species itself, is influenced by its preference for moist soil and a patchwork of short and long vegetation (8 – 25cm). Availability of the food plant is, also, strongly correlated with elevation in (Botham *et al.*, 2011).

Vegetation structure within the sward has been shown to be important; the height of the surrounding vegetation is likely to be important in creating and maintaining the optimal microclimatic conditions necessary for larval survival (Porter, 1981; Konvicka *et al.* 2003; Fowles and Smith 2006; cited in Botham *et al.*, 2011) and there must be a patchwork of open areas within the sward where larvae can receive sunlight close to ground level which allows them to bask.

In addition to the constraints outlined in the preceding paragraphs slope aspect is an important factor influencing the selection of egg laying locations. Because the larvae need sunlight that penetrates close to ground level the female selects plants that face south, southwest or south east that are sheltered, but not overshadowed or obstructed, by a tussock of sheltering grass or scrub e.g. gorse (*Ulex* spp.) heather or bog myrtle (*Myrica gale*). On exposed west facing slopes the eggs are placed on sheltered plants near the base of the slopes. North facing slopes are never used.³

Colonies have been recorded on sand dunes, fens, cutover raised bogs, blanket bogs, wet heaths, unimproved wet, neutral or calcareous grasslands, calcareous and coastal heaths. The sites that support these colonies are maintained by a variety of management, accidental or deliberate, including grazing and burning. Most sites are in lowland locations below 200m but it has been recorded up to 350m and perhaps higher in recent years.

These habitat conditions can be present on the edges of bogs and fens, sand dunes, limestone pavement and tracksides but not on improved grassland, intact bogs, deeply flooded sites or woodland⁴.

3 DESCRIPTION OF THE SITE

The Carrownagowan Wind Farm site is situated in an upland area (approx. 200-420m OD), on the north-western slopes of the Slieve Bearnagh Mountains. It covers an area of approx. 750 ha which principally consists of conifer plantation. Remnant areas of cutover bog, raised bog, blanket bog and wet heath also occur but these are quite discontinuous and fragmented due to the development and expansion of forestry. While some of the remnant areas of bog retain some of the original peat mass most are significantly degraded as a result of the impacts, particularly, on ground water flows,

³ Content in this paragraph adapted from Harding (2009)

⁴ Content in this paragraph derived from NPWS (2019)

caused by the forestry operations. It is reasonable to assume that, historically there were significant volumes of the original peat mass removed due to peat extraction.

A number of wet grassland fields are also present. These appear to be reverting from a state where they were once improved forms of agricultural grassland subject to intensive management for at least some period of time.

4 METHODOLOGY

4.1 SURVEY LOCATION SELECTION

A review of satellite imagery established that a significant proportion of the site comprises conifer plantation in various stages from clearfell through to mature stands and is, therefore, unsuitable for Marsh fritillary. Seven survey locations (see Drawing in Appendix 3) were chosen on the basis that they were not conifer woodland and they retained some degree of semi naturalness in the context of the highly modified condition of most of the Carrownagowan Wind Farm site. **Table 1**, below, lists the survey locations and indicates the range of elevation, the slope aspect and the broad habitat category of each.

Table 1: Description of topographical and habitat characteristics of the Survey Locations

Survey Location (SL)	Elevation Range across SL	Slope Aspect	Habitat Type (Desktop)
1	220 m to 260 m	North-east	Cutover bog
2	180 m	North	Cutover bog
3	240 m	North	Wet woodland/conifer
4	190 m to 230 m	North-east	Wet grassland
5	210 m to 250 m	North-east	Wet grassland (north) Heath/bog (south)
6	200 m to 270 m	North-east	Wet grassland (north) Heath/bog (south)
7	175 m	North-east	Indeterminate semi natural

4.2 SURVEY DESIGN

4.2.1 Constraints

For Health and Safety reasons Survey Location 3 was not surveyed.

4.2.2 Habitat Condition Survey

In order to ensure that a standard replicable survey protocol was implemented the Habitat Condition Survey design was based on the methodology outlined in the National Biodiversity Data Centre's (NBDC) Habitat Condition Assessment for Marsh Fritillary⁵ and the surveyor used an adapted version of the survey form provided by the NBDC. Both are included in the Appendices to this document.

The Habitat Condition Survey involved the collection of data on the following criteria for each sample location:

⁵ Available at: <http://www.biodiversityireland.ie/wordpress/wp-content/uploads/Marsh-Fritillary-Habitat-Condition-Form.pdf>

- Vegetation height recorded by the average band in which the sample fell into: (A = <12cm, B = 12-25cm, C = 25-50cm, and D = >50cm);
- % frequency of devil's bit scabious abundance;
- Where present, devil's bit scabious abundance: (A = 1-2 plants /m², B = 3-9 plants /m², C=10+ plants /m², and D = no plants);
- Presence of habitat structure: tussocks/dominant tussock-forming species;
- Presence of low invading scrub;
- Evidence of stock grazing (poaching, dung etc.);
- Grid-co-ordinates

Use of these criteria ensured areas of dense and/or extensive devil's-bit scabious situated within a reasonably open sward could be identified and recorded. Details of other characteristics including slope aspect, exposure and information on the extent of management, if any, were also recorded.

4.2.3 Larval Web Survey

In the event that the food plant was encountered in suitable sward the surveyor had copies of the NBDC's Marsh Fritillary Larval Web Survey/Monitoring Recording Form⁶ a copy of which is included in the Appendices to this document. The purpose of the survey was to determine presence/absence of the larval stage of Marsh fritillary within suitable habitats. This design comprises a plotted zigzag walk, covering as much of the suitable habitat as possible, targeting areas most likely to support webs e.g. south-facing slopes, dense patches of the food plant, structured vegetation patches and sheltered locations.

5 RESULTS

5.1.1 Habitat Condition Survey

No suitable habitat was recorded at any location.

While devil's bit scabious was recorded at 2 locations, namely 4 and 5, the plant's distribution was, in general, quite diffuse within these locations and where the plant was to any extent locally abundant, as required by marsh fritillary, the individual plants, and in particular the basal leaves and stem bases on which the larvae feed and bask, were buried within the tall, rank dense vegetation which dominated the plots. The dense, rank vegetation blocked any sunlight penetrating to ground level thereby precluding any possibility that the plants could support the basking requirements, and therefore the survival, of the larval stage. The density and height of the surrounding vegetation also prevented ease of movement between plants - also a requirement of the larval stage.

Location 4 is divided into 2 fields one on either side of the forest track; locations 5 & 6 comprise linear corridors each in excess of 800 m with marked habitat transition along the corridor. In the interest of accuracy and clarity they are, therefore, subdivided into north and south sections in **Table 2**, below.

⁶ Available at: <http://www.biodiversityireland.ie/wordpress/wp-content/uploads/Marsh-Fritillary-Larval-Survey-Form.pdf>

Table 2: Suitability Criteria recorded at each Survey Location

Survey Location (SL)	Average elevation across SL	% frequency of scabious	% frequency of structured vegetation	% frequency of 12-25 cm swards	% frequency of stock grazing signs
1	> 200 m	0	0	0	0
2	> 200 m (205 m)	0	0	0	0
3	> 200 m	0	0	0	0
4 north	> 200 m (210 m)	20	0	20	0
4 south		10	0	0	0
5 north	> 200 m	10	10	0	0
5 south		0	0	0	0
6 north	> 200 m	0	0	0	0
6 south		0	0	0	0
7	< 200	0	0	0	0

As was noted in **Section 4.2.1**, above, survey location 3 was not accessible. However, it is not within the development footprint.

5.1.2 Larval Web Survey

In light of the results of the Habitat Condition Survey a larval web survey was not warranted. However, a selection of plants was examined for the particular type of damage to the leaf mesophyll which is a diagnostic of larval feeding by marsh fritillary.

No such damage was observed on any plant.

6 DISCUSSION

With regard to the results of the survey and the extent to which they accurately indicate the potential of the Survey Locations to support Marsh fritillary, it is concluded, in light of the fact that availability of the food plant is strongly correlated with elevation (Botham *et al.*, 2011) and bearing in mind that most sites in Ireland that support the species are in lowland situations below 200m (NPWS, 2019) the fact that much of the site is situated above 200 m strongly suggests that the site is inherently of lower value to the species than the various adjacent hectads where the species is recorded (see paragraph 1, **Section 1**, above). In addition, the fact that 2 of the locations face north and the remainder north–east may further reduce the potential suitability of the locations given that north facing slopes are never used for laying and females preferentially select plants that face south, southwest or south east (Harding, 2009). In light of the species' highly specific requirements and the consequent site selectivity preferences as expressed in the species' behaviours, described in **Section 2**, above, use of the site by the species is not reasonably foreseeable.

In light of the results outlined in **Section 5**, above, and the observations in the preceding paragraph it is concluded that, due to a number of immutable constraints including elevation, slope aspect, habitat quality and the species' behaviours in site selection the Carrownagowan Wind Farm site does not have the capacity to support Marsh fritillary and is unlikely to do so in the future.

7 REFERENCES

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Harding, J., (2009). *Discovering Irish Butterflies & their Habitats*. Jesmond Harding.

Heath, J., Pollard, E. and Thomas, J.A. (1984) *Atlas of Butterflies in Britain and Ireland*. Viking, Harmondsworth.

Regan, E.C., Nelson, B., Aldwell, B., Bertrand, C., Bond, K., Harding, J., Nash, D., Nixon, D., & Wilson, C.J. (2010) *Ireland Red List No. 4 – Butterflies*. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.

NPWS (2019). *The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments*. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O’Neill

Appendix 1

NBDC Survey Sheets

HABITAT CONDITION ASSESSMENT FOR MARSH FRITILLARY

Habitat condition monitoring for the Marsh Fritillary involves fixed point habitat recording on a structured walk across a site, from which an assessment can be made. A separate survey and assessment should be completed for each sub-site.

METHOD

- Establish a W shape (zigzag) route that will cross thoroughly and evenly the whole site/sub-site.
- Decide stopping distances along this route where recordings of habitat condition will be made e.g. every 10 or 20 paces. Aim to have at least 20 stopping points for a small site (<1 ha) more than 40 stopping points for a medium-sized site (1-5 ha) and more than 50 stopping points for a large site (>5 ha).
- Follow your route and at each stopping point measure (in cm) the vegetation height at the point you stop (measure to the top of the leaves i.e. ignore the flowers of grasses and plants). Then, using an imaginary box with sides of 1 m in front of you, record the presence of Devil's-bit Scabious in one of these abundance categories (A = 1-2 plants, B = 3-9 plants, C = 10+ plants, D = No plants). Using the same area, record (mark with an 'X') the presence or absence of these three habitat attributes: structured vegetation, low (<25 cm tall) invading scrub with a cover of >10% and stock grazing signs (e.g. tracks, poach marks, dung).
- At the end of the assessment, then provide an estimate the cover (%) of tall (>0.5 m) scrub for the whole site/sub-site.

MARSH FRITILLARY HABITAT CONDITION SURVEY FORM






SITE NAME		SUB-SITE	
OS GRID REF		RECORDER(S)	
SURVEY DATE		TALL SCRUB COVER (%)	
MANAGEMENT OBSERVATIONS (e.g. enclosed, recently grazed or cut, peat cutting, burning, etc.)			
ASPECT AND SLOPE DESCRIPTION The main aspect and a brief description of whether the site has suitable habitat covering a variety of aspects (including variation at a micro scale such as banks)			
EXPOSURE (e.g. high exposure sites would be open coastal sites)			

STRUCTURED WALK RECORDS

Key for recording attributes:

1. Vegetation Height:	A = <12 cm	B = 12-25 cm	C = 25-50 cm	D = >50 cm
2. Devil's bit scabious:	A = 1-2 plants/m ²	B = 3-9 plants/m ²	C = 10+ plants/m ²	D = None
3. Structured vegetation:	Mark with an 'X' if there is presence of any steps in vegetation or ground that provide localised protection from elements at ground level. See figure below for guidance.			
4. Low invading scrub:	Tick if low invading scrub (e.g. birch, gorse, bog myrtle) <25 cm tall and >10% cover present. The word 'invading' is important here. Do not include scrub that is an integral part of the habitat (e.g. Juniper in Juniper heath systems).			
5. Evidence of stock grazing:	Tick if localised evidence present (e.g. poaching, dung, etc.)			

Example of Structured Vegetation:

				
No		Yes		
Varied vegetation height, bank or slope change, small tussocks or poaching etc.				

Stop number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Vegetation Height																				
2. Devil's-bit Scabious abundance																				
<i>Mark with an 'X' if attributes below are present at each stop</i>																				
3. Structured vegetation																				
4. Low invading scrub																				
5. Evidence of stock grazing																				

Stop number	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1. Vegetation Height																				
2. Devil's-bit Scabious abundance																				
<i>Mark with an 'X' if attributes below are present at each stop</i>																				
3. Structured vegetation																				
4. Low invading scrub																				
5. Evidence of stock grazing																				

Stop number	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1. Vegetation Height																				
2. Devil's-bit Scabious abundance																				
<i>Mark with an 'X' if attributes below are present at each stop</i>																				
3. Structured vegetation																				
4. Low invading scrub																				
5. Evidence of stock grazing																				

DATA ANALYSIS (Optional)

At the end of the field survey, calculate the following for each area sampled:

MEAN VEG. HEIGHT (cm)		% FREQUENCY OF CATEGORY B/C SCABIOUS IN <12 cm SWARDS	
% FREQUENCY OF SCABIOUS		% FREQUENCY OF CATEGORY B/C SCABIOUS IN >25 cm SWARDS	
% FREQUENCY OF SCABIOUS CATEGORY A		% FREQUENCY OF STRUCTURED VEGETATION	
% FREQUENCY OF SCABIOUS CATEGORY B		% FREQUENCY OF LOW INVADING SCRUB	
% FREQUENCY OF SCABIOUS CATEGORY C		% FREQUENCY OF STOCK GRAZING SIGNS	
% FREQUENCY OF 12-25 cm SWARDS		TALL (>0.5 m) SCRUB COVER (%)	
% FREQUENCY OF CATEGORY B/C SCABIOUS IN 12-25 cm SWARDS			

HABITAT CONDITION ASSESSMENT

Assess the condition to one of the following categories:

Good Condition Habitat (GC): >20% freq. of Scabious of category B/C abundance growing in 12-25 cm tall swards and <10% cover of tall scrub (>0.5 m tall)

Suitable (Under-grazed) Habitat (SU): >20% freq. of Scabious of category B/C abundance growing in >25 cm tall swards and <20% freq. of Scabious of category B/C abundance growing in 12-25 cm tall swards

Suitable (Over-grazed) Habitat (SO): >20% freq. of Scabious of category B/C abundance growing in <12cm tall swards and <20% freq. of Scabious of category B/C abundance growing in 12-25 cm tall swards

Unsuitable habitat (US): <5% freq. of Scabious of category B/C abundance growing in >25 cm tall swards

MANAGEMENT ALERTS

Undergrazing indicators	Overgrazing indicators
>10% cover of tall scrub (>0.5 m tall)	<25% frequency of structured vegetation
>75% frequency of structured vegetation	>80% frequency of evidence of stock grazing
>10% frequency of low invading scrub with >10% cover	Mean vegetation height <12 cm
<20% frequency of evidence of stock grazing	
Mean vegetation height >25cm	

SUMMARY DATA ANALYSIS

CONDITION CATEGORY		NOTES
MANAGEMENT ISSUES		

MARSH FRITILLARY LARVAL WEB SURVEY/MONITORING

INFORMATION SHEET FOR SURVEYORS

The standard method for surveying or monitoring Marsh Fritillary by larval web counts is described below. Please record any data on the enclosed '**Marsh Fritillary Larval Web Recording Form**'. Data recorded in this way will be of most use for conservation purposes.

How to survey/monitor:

1. The best period to survey is when the webs are most conspicuous, ideally during late August or early September. Counts can be done into mid to late September but often by then the larvae will have entered hibernation, or heavy rain may destroy the webs.
2. Prepare a large scale map of your target site (1:5,000 or enlarged 1:20,000) to take with you.
3. If you are looking for larvae on a potential new site (**survey**) first identify the extent of habitat which looks suitable for the butterfly, the best indicator being the presence of abundant Devil's-bit Scabious (the larval food plant). Search this area systematically, recording the number of **occupied** larval webs that you see. Mark the location of any occupied webs found on your map with a cross (x). If the site is large, or you do not have time to conduct a full search, walk a path (transect) through the identified habitat recording any occupied webs 1m either side of you (i.e. a 2m band across the site). In this case you will need to mark the route you have taken on your map and record its length in metres. Aim to cover around 100m per hectare depending on the size of the site, do not preferentially target areas with dense Devil's-bit Scabious but take a path which covers a representative sample of the total area of suitable habitat.
4. If you have offered to help with **monitoring** a known breeding site you can also search all suitable habitat in a systematic way or walk a sample transect through the suitable habitat as above. In this case you are likely to have been provided with a map of previous larval web locations and any established sampling path to guide your efforts.
5. It is unnecessary to count individual larvae or webs with no larvae present (unless vacated webs are the only record for the site). If in doubt stop and look closely at a proportion of the webs, sometimes they appear to have larvae when only shed larval skins are present. Note any moribund larvae surrounded by the small white cocoons of the parasitic braconid wasp *Cotesia*.
6. Mark on your map the boundary of suitable habitat and the path taken if the site was sampled rather than systematically searched. Estimate the area of suitable habitat in hectares, if you can, and give an approximate length of your sample path (transect) in metres, as well as the total number of occupied webs found for the whole site or per sub-section if you have divided the site into a number of areas (show these clearly on the map).
7. Complete the habitat information boxes as far as possible and add clarifying notes on management or site access.
8. Even if larval webs are not found please record the habitat information for sites which appear suitable for the butterfly but do not presently have them.

General Information:

1. ACCESS

Please make sure you have the permission of the owner before surveying a site.

2. HEALTH & SAFETY

Surveyors should be aware of the potential risks of field surveying and should take sensible precautions to reduce these risks.

If you have any queries please contact: Brian Nelson at Brian.Nelson@ahg.gov.ie or Tomás Murray at tmurray@biodiversityireland.ie.



MARSH FRITILLARY LARVAL WEB

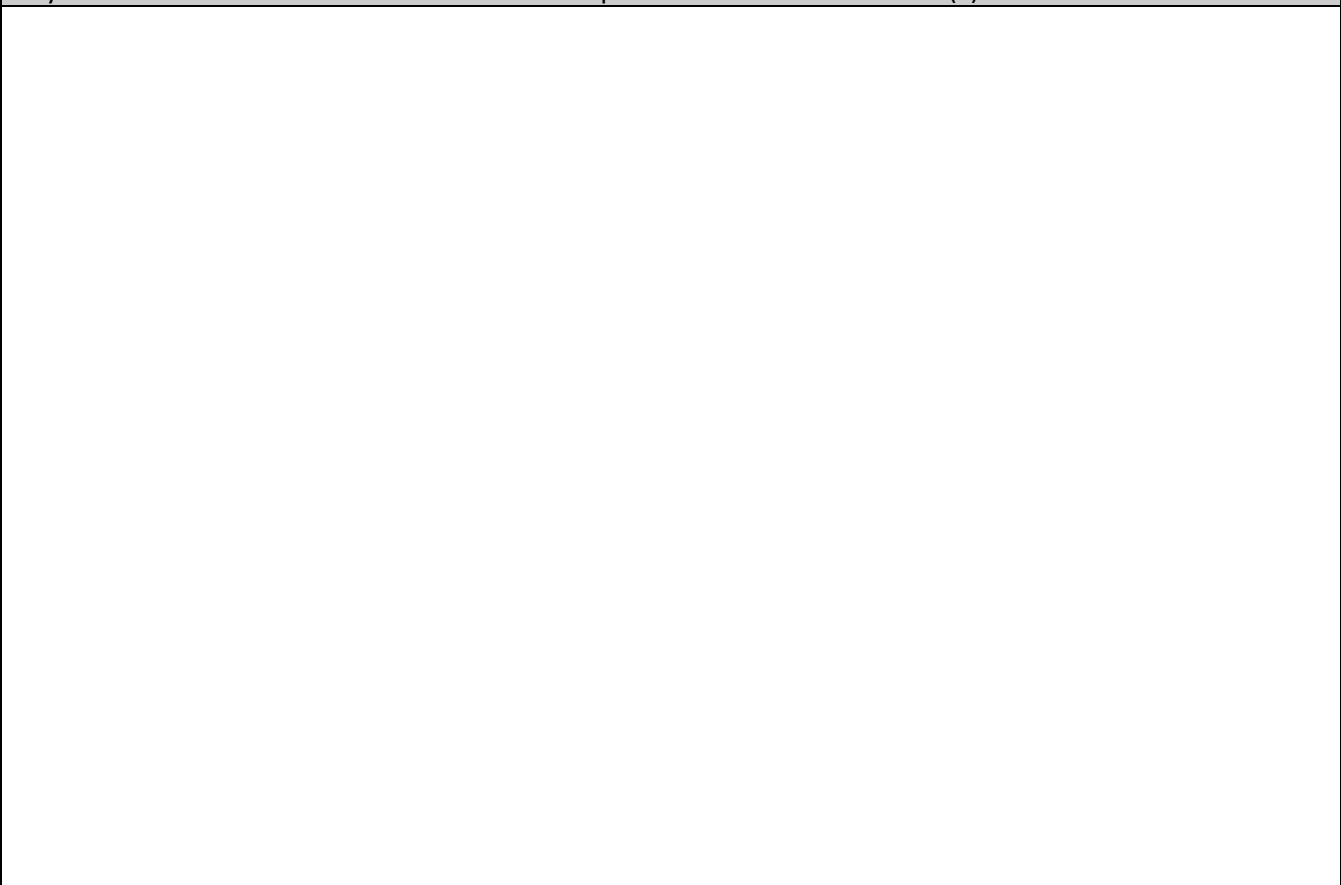
RECORDING FORM

SITE DETAILS

SITE NAME:		NETWORK/ LARGER SITE:	
COUNTY:		PRINCIPAL HABITAT:	
VICE COUNTY:		SECONDARY HABITAT:	
CENTRAL GRID REF.: (e.g.S215502)			
RECORDER NAME & CONTACT DETAILS:			
SITE OWNER & CONTACT FOR ACCESS:			

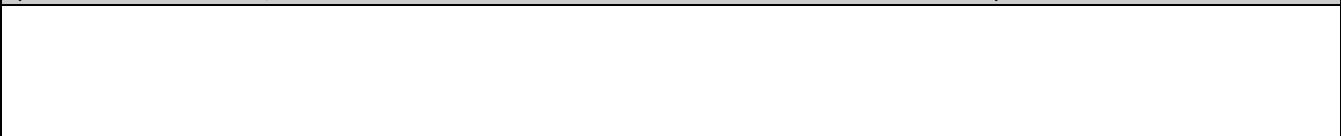
SITE MAP

Copy/Attach an OS map at 1:10 000 or equivalent showing scale, 1 km gridlines and boundary of suitable and/or occupied habitat marked by thick black line (use a separate sheet if necessary). Please mark the route of your transect and indicate the location of occupied larval webs with a cross (x).



PREVIOUS RECORDS

Are there previous records of Marsh Fritillary adults or larvae at this site?
(Please include dates, numbers of adults or larvae recorded and recorder if known)



LARVAL WEB SURVEY/ MONITORING

DATE OF VISIT:	SITE/SUB-SITE (if applicable):	NUMBER OF OCCUPIED WEBS FOUND:	LENGTH OF TRANSECT (metres):	AREA OF SUITABLE HABITAT (hectares):	POPULATION SIZE/ ESTIMATED POP. SIZE (webs):

N.B.: Estimated population size if sample survey, not full search, is given by multiplying up the proportion of webs found in the sample area given in ha (length of transect in m x 2m width/ 10,000) to the total area of suitable habitat (1 ha = = 100 m x 100 m = 10,000 m²).

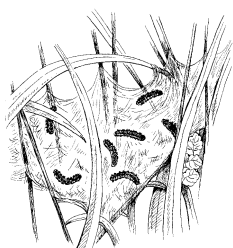
HABITAT OBSERVATIONS

(N.B.: Complete a separate HABITAT CONDITION ASSESSMENT FORM if conducting a detailed survey)

Please indicate the abundance of Devil's-bit Scabious over the site surveyed (circle one category)	Average vegetation height (circle one category)	Animal poaching (circle one category)
Widespread and abundant	<5cm	No livestock hoof marks
Frequent	5 to 12cm	Hoof marks confined to tracks
Patchy (locally abundant)	12 to 25cm	Some poaching of wetter areas
Patchy Sparse	>25cm	Majority of site poached
Rare		

Additional notes on present habitat condition and management – such as types of animals grazing, any burning or mowing; and suggested management needs.

The information supplied here is sent to the National Biodiversity Data Centre on the understanding that the data provided by the recorder will be entered into a computerised database and will be used for nature conservation, research, education and public information.



Please send the completed form to:

National Biodiversity Data Centre,
WIT West Campus,
Carriganore,
Waterford,
X91 PE03

Appendix 2

Adapted version of NBDC Marsh fritillary Habitat Condition Assessment Survey Sheet

MARSH FRITILLARY HABITAT CONDITION SURVEY FORM

SITE NAME		SUB-SITE	
OS GRID REF		RECORDER(S)	
SURVEY DATE		TALL SCRUB COVER (%)	
MANAGEMENT OBSERVATIONS (e.g. enclosed, recently grazed or cut, peat cutting, burning, etc.)			
ASPECT AND SLOPE DESCRIPTION The main aspect and a brief description of whether the site has suitable habitat covering a variety of aspects (including variation at a micro scale such as banks)			
EXPOSURE (e.g. high exposure sites would be open coastal sites)			

DATA ANALYSIS (Optional)

At the end of the field survey, calculate the following for each area sampled:

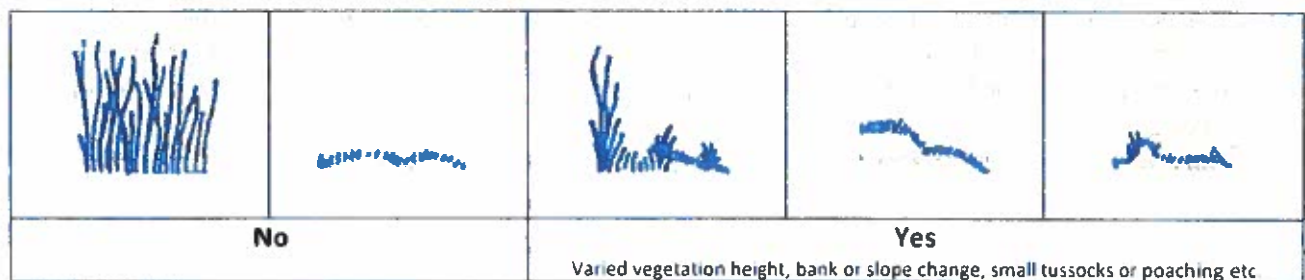
MEAN VEG. HEIGHT (cm)		% FREQUENCY OF CATEGORY B/C SCABIOUS IN <12 cm SWARDS	
% FREQUENCY OF SCABIOUS		% FREQUENCY OF CATEGORY B/C SCABIOUS IN >25 cm SWARDS	
% FREQUENCY OF SCABIOUS CATEGORY A		% FREQUENCY OF STRUCTURED VEGETATION	
% FREQUENCY OF SCABIOUS CATEGORY B		% FREQUENCY OF LOW INVADING SCRUB	
% FREQUENCY OF SCABIOUS CATEGORY C		% FREQUENCY OF STOCK GRAZING SIGNS	
% FREQUENCY OF 12-25 cm SWARDS		TALL (>0.5 m) SCRUB COVER (%)	
% FREQUENCY OF CATEGORY B/C SCABIOUS IN 12-25 cm SWARDS			

STRUCTURED WALK RECORDS

Key for recording attributes:

1. Vegetation Height:	A = <12 cm	B = 12-25 cm	C = 25-50 cm	D = >50 cm
2. Devil's bit scabious:	A = 1-2 plants/m ²	B = 3-9 plants/m ²	C = 10+ plants/m ²	D = None
3. Structured vegetation:	Mark with an 'X' if there is presence of any steps in vegetation or ground that provide localised protection from elements at ground level. See figure below for guidance.			
4. Low invading scrub:	Tick if low invading scrub (e.g. birch, gorse, bog myrtle) <25 cm tall and >10% cover present. The word 'invading' is important here. Do not include scrub that is an integral part of the habitat (e.g. Juniper in Juniper heath systems).			
5. Evidence of stock grazing:	Tick if localised evidence present (e.g. poaching, dung, etc.)			

Example of Structured Vegetation:

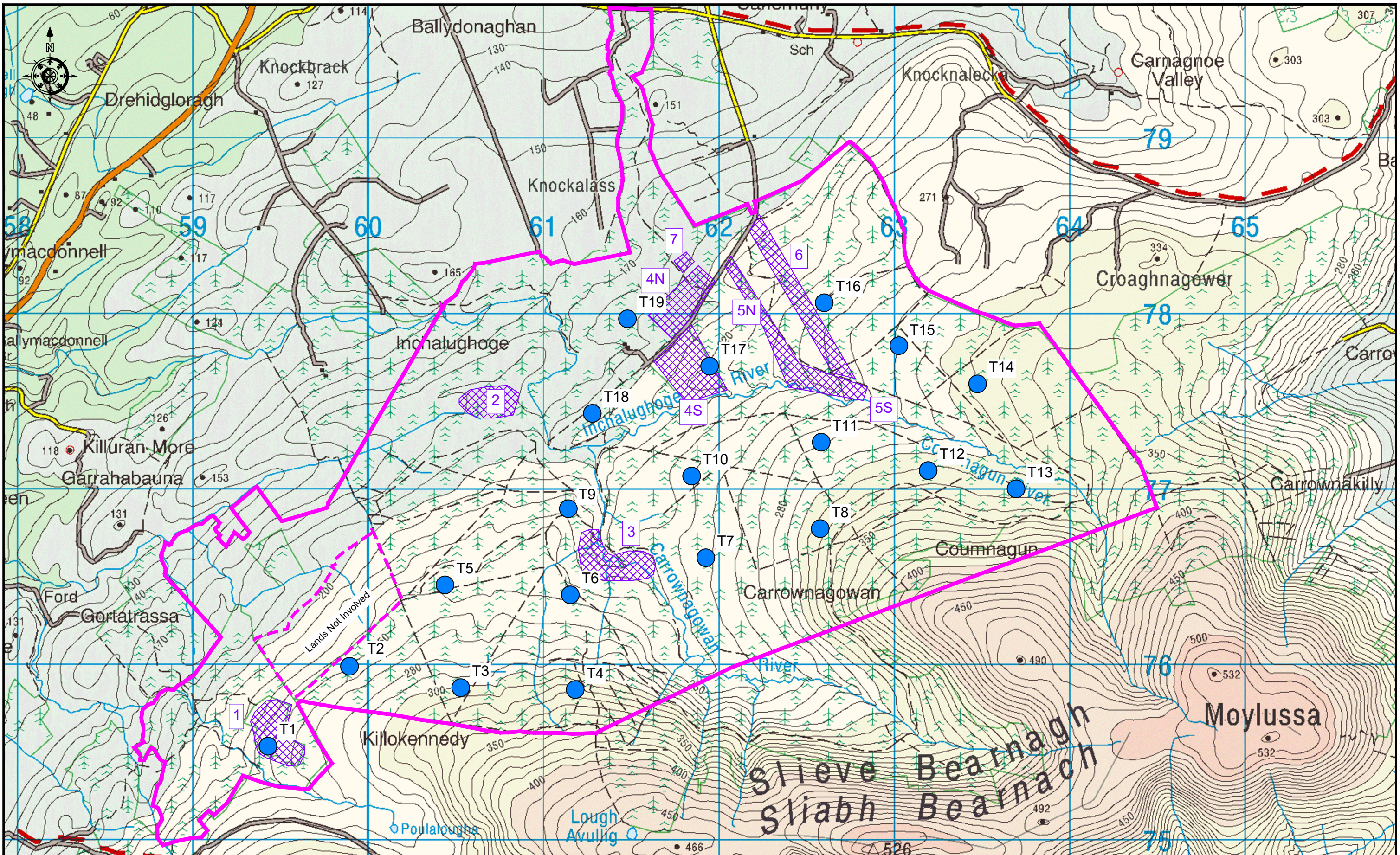


Stop number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1. Vegetation Height																					
2. Devil's-bit Scabious abundance																					
Mark with an 'X' if attributes below are present at each stop.																					
3. Structured vegetation																					
4. Low invading scrub																					
5. Evidence of stock grazing																					

Stop number	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
1. Vegetation Height																					
2. Devil's-bit Scabious abundance																					
Mark with an 'X' if attributes below are present at each stop.																					
3. Structured vegetation																					
4. Low invading scrub																					
5. Evidence of stock grazing																					

Stop number	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	
1. Vegetation Height																					
2. Devil's-bit Scabious abundance																					
Mark with an 'X' if attributes below are present at each stop.																					
3. Structured vegetation																					
4. Low invading scrub																					
5. Evidence of stock grazing																					

Appendix 3: Figure



Legend

- Turbine Location
- Study Area
- Lands Not Involved in Study Area
- Survey Location

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Rev.	Date	Description	by	ch'd	app
A	08.11.19	Issued For Information	JK	PR	PR

Client

Project	Carrownagowan Wind Farm
Title	Marsh Firtillary Habitat Condition Survey Locations

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:20,000	Drg. No.	19107-SK33	Rev.	A
Drawn	JK	08.11.2019			
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